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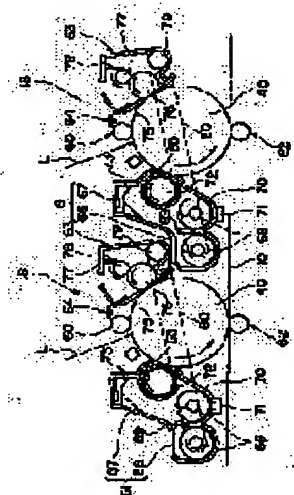
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(54) IMAGE FORMING DEVICE, MONOCHROMATIC IMAGE FORMING MEANS LOADED TO THE SAME, AND TONER RECYCLING DEVICE LOADED TO THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To enable individually recycling toner while preventing the deterioration of image quality by preventing foreign matter from being mixed into the recycled toner, as for an image forming device.

SOLUTION: A monochromatic image forming means 18 is constituted by providing a developing device 61 and an image carrier cleaning device 63, etc., around an image carrier 40. A tandem image forming device is constituted by horizontally arranging several monochromatic image forming means along the rotary-carrying direction of a belt type intermediate transfer body 10, and a synthesized toner image is formed on the intermediate transfer body in the tandem image forming device, then, the synthesized toner image is transferred to a transfer material, then, a multicolor image is recorded on the transfer material. A toner recycling device 80 for carrying the toner recovered by the image carrier cleaning device 63 to the developing device 61 is separately installed in at least two of the monochromatic image forming means constituting the tandem image forming device.



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CLAIMS

[Claim(s)]

[Claim 1] In preparation for the surroundings of image support, a monochrome imaging means is constituted for a developer and image support cleaning equipment. In image formation equipment which once imprints a toner image formed on image support of the monochrome imaging means on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Two or more said monochrome imaging means are put in order along the rotation conveyance direction of said middle imprint object. Tandem imaging equipment which forms a multi-colored picture image on said middle imprint object is constituted. Image formation equipment which comes to prepare for at least two monochrome imaging means toner recycle equipment which conveys a toner collected with said image support cleaning equipment to said developer among said monochrome imaging means to constitute the tandem imaging equipment.

[Claim 2] Image formation equipment according to claim 1 which compounds a monochrome image formed with said each monochrome imaging means through said middle imprint object, and comes to form a synthetic color picture on imprint material.

[Claim 3] Image formation equipment according to claim 2 which comes to prepare said toner recycle equipment for a monochrome imaging means to arrange in a rotation conveyance direction maximum upstream location of said middle imprint object, with said tandem imaging equipment.

[Claim 4] Image formation equipment according to claim 2 which comes to prepare said toner recycle equipment for a black monochrome imaging means at least among said two or more monochrome imaging means.

[Claim 5] Image formation equipment according to claim 2 which comes to arrange a black monochrome imaging means with said tandem imaging equipment in the rotation conveyance direction lowest style location of said middle imprint object.

[Claim 6] Image formation equipment according to claim 1 which puts in order and establishes said two monochrome imaging means along the rotation conveyance direction of said middle imprint object, compounds a monochrome image formed with those monochrome imaging means through said middle imprint object, and comes to form 2 color images in imprint material.

[Claim 7] Claim 1 said whose image support is a drum and said whose middle imprint object is a belt thru/or image formation equipment given in any 1 of 6.

[Claim 8] Claim 1 both said image support and said whose middle imprint object are belts thru/or image formation equipment given in any 1 of 6.

[Claim 9] Claim 1 which comes to constitute a process cartridge which prepares said image support at least, bundles up to a main part of image formation equipment, and is detached and attached thru/or image formation equipment given in any 1 of 6.

[Claim 10] A developer and image support cleaning equipment are constituted in preparation for the surroundings of image support. In a monochrome imaging means of image formation equipment which once imprints a toner image formed on the image support on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Among those which put more than one in order along the rotation conveyance direction

of said middle imprint object, constitute tandem imaging equipment which forms a multi-colored picture image on said middle imprint object, and constitute the tandem imaging equipment, to at least two things A monochrome imaging means of image formation equipment which comes to have toner recycle equipment which conveys a toner collected with said image support cleaning equipment to said developer.

[Claim 11] In preparation for the surroundings of image support, a monochrome imaging means is constituted for a developer and image support cleaning equipment. In toner recycle equipment of image formation equipment which once imprints a toner image formed on image support of the monochrome imaging means on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Two or more said monochrome imaging means are put in order along the rotation conveyance direction of said middle imprint object. Tandem imaging equipment which forms a multi-colored picture image on said middle imprint object is constituted. Toner recycle equipment of image formation equipment which comes to convey a toner which equipped at least two monochrome imaging means with among said monochrome imaging means to constitute the tandem imaging equipment, and which were collected with said image support cleaning equipment to said developer.

[Claim 12] In preparation for the surroundings of image support, a monochrome imaging means is constituted for a developer and image support cleaning equipment. In image formation equipment which once imprints a toner image formed on image support of the monochrome imaging means on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Image formation equipment which establishes one monochrome imaging means to form a monochrome image, on the middle imprint object, and comes to prepare for the surroundings of said middle imprint object toner recycle equipment which conveys a toner collected with said image support cleaning equipment at the monochrome imaging means to said developer.

[Claim 13] Image formation equipment according to claim 12 said whose image support is a drum and said whose middle imprint object is a belt or a drum.

[Claim 14] Image formation equipment according to claim 12 said whose image support is a belt and said whose middle imprint object is a belt or a drum.

[Claim 15] Image formation equipment according to claim 12 which comes to constitute a process cartridge which prepares said image support at least, bundles up to a main part of image formation equipment, and is detached and attached.

[Claim 16] A developer and image support cleaning equipment are constituted in preparation for the surroundings of image support. In a monochrome imaging means of image formation equipment which once imprints a toner image formed on the image support on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material A monochrome imaging means of image formation equipment which comes to have toner recycle equipment which conveys a toner which prepared in the surroundings of said middle imprint object, formed a monochrome image on the middle imprint object, and were collected with said image support cleaning equipment to said developer.

[Claim 17] In preparation for the surroundings of image support, a monochrome imaging means is constituted for a developer and image support cleaning equipment. In toner recycle equipment of image formation equipment which once imprints a toner image formed on image support of the monochrome imaging means on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Toner recycle equipment of image formation equipment which comes to convey a toner which established one monochrome imaging means to form a monochrome image, on the middle imprint object, and equipped the monochrome imaging means with, and which were collected with said image support cleaning equipment around said middle imprint object to said developer.

[Claim 18] Image formation equipment according to claim 1 or 12 which impresses development bias voltage to said developer at the time of development, and comes to form mutual electric field.

[Claim 19] Image formation equipment according to claim 1 or 12 which comes to use a toner containing a release agent.

- [Claim 20] Image formation equipment according to claim 1 or 12 with which circularity comes to use 90 or more toners.
- [Claim 21] Image formation equipment according to claim 1 or 12 which comes to use a toner whose half-value width is below $2.2 [fC / 10 \text{ micrometers}]$ in a distribution curve of (amount of electrifications of toner)/(toner particle size).
- [Claim 22] Image formation equipment according to claim 1 or 12 which comes to prepare an elastic layer in said middle imprint object.
- [Claim 23] Image formation equipment according to claim 1 or 12 which comes to form in the surface of said middle imprint object at homogeneity a toner adhesion force reduction layer which reduces adhesion force of a toner.
- [Claim 24] Image formation equipment according to claim 23 which comes to form said toner adhesion force reduction layer using zinc stearate.
- [Claim 25] Image formation equipment according to claim 23 which comes to form said toner adhesion force reduction layer using a fluororesin.
- [Claim 26] Image formation equipment according to claim 23 which adheres a particle which uses a brush and it failed to delete from a particle binding object to said middle imprint object, and comes to form said toner adhesion force reduction layer by the adhering particle.
- [Claim 27] Along the rotation conveyance direction of said middle imprint object from a location which gives a charge to the surface of the middle imprint object When distance to a location which moves a toner on the middle imprint object is set to L_0 , surface migration speed of the middle imprint object, a volume resistivity, and specific inductive capacity are set to V_L , ρ_V , and ϵ , respectively and the dielectric constant of vacuum is set to ϵ_0 , Image formation equipment according to claim 1 or 12 which becomes as $L_0 - \frac{V_L}{\rho_V \epsilon - \epsilon_0}$.
- [Claim 28] A location which imprints a toner image on said image support on said middle imprint object is made into a primary imprint location. Distance between shortest primary imprint locations in an adjoining primary imprint location is set to L_1 along the rotation conveyance direction of said middle imprint object. Image formation equipment according to claim 1 which becomes as $L_1 - \frac{V_L}{\rho_V \epsilon - \epsilon_0}$ when surface migration speed of the middle imprint object, a volume resistivity, and specific inductive capacity are set to V_L , ρ_V , and ϵ , respectively and the dielectric constant of vacuum is set to ϵ_0 .
- [Claim 29] A location which imprints a toner image on said image support on said middle imprint object is made into a primary imprint location. And when a location which imprints a toner image on said middle imprint object to imprint material is made into a secondary imprint location and distance from said primary imprint location of the lowest style to said secondary imprint location is set to L_2 along the rotation conveyance direction of said middle imprint object, Image formation equipment according to claim 27 which becomes as $L_2 - \frac{V_L}{\rho_V \epsilon - \epsilon_0}$.
- [Claim 30] A location which imprints a toner image on said middle imprint object to imprint material is made into a secondary imprint location. And a location which removes a residual toner on said middle imprint object with middle imprint object cleaning equipment after an imprint is made into a middle imprint object cleaning location in the secondary imprint location. Image formation equipment according to claim 27 which becomes as $L_3 - \frac{V_L}{\rho_V \epsilon - \epsilon_0}$ when distance from said secondary imprint location to said middle imprint object cleaning location is set to L_3 along the rotation conveyance direction of said middle imprint object.
- [Claim 31] A location which removes a residual toner on said middle imprint object with middle imprint object cleaning equipment after an imprint is made into a middle imprint object cleaning location in a secondary imprint location. And a location which imprints a toner image on said image support on said middle imprint object is made into a primary imprint location. Image formation equipment according to claim 27 which becomes as $L_4 - \frac{V_L}{\rho_V \epsilon - \epsilon_0}$ when distance from said middle imprint object cleaning location to said primary imprint location of the maximum upstream is set to L_4 along the rotation conveyance direction of said middle imprint object.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[The technical field to which invention belongs] This invention relates to the image formation equipment which a copying machine, a printer, facsimile, or those compound machines repeat electrification, writing, development, an imprint, cleaning, etc., form a toner image serially on image support using two components or 1 component developer, imprint that toner image through a middle imprint object, and forms images, such as a color, 2 colors, and monochrome, on imprint material. And in such image formation equipment, it is related with a monochrome imaging means to constitute a developer and image support cleaning equipment in preparation for the surroundings of image support. And in such a monochrome imaging means, it is related with the toner recycle equipment which conveys to a developer the toner collected with image support cleaning equipment.

[0002]

[Description of the Prior Art] Conventionally, there are what forms a monochromatic monochrome toner image in imprint material, such as a form and an OHP film, and a thing which forms multicolor 2 color toner image or a multicolor color toner image in image formation equipment.

[0003] Among those, with the image formation equipment which forms a monochrome toner image, in preparation for the surroundings of image support, the monochrome imaging means of 1 was constituted for a developer and image support cleaning equipment, the monochrome toner image was formed on image support with the monochrome imaging means of 1, the toner image was directly imprinted from image support, and the image was usually formed on imprint material so that it might be indicated by JP,8-248708,A, for example.

[0004] On the other hand, there are some which imprint the toner image on the middle imprint object, and form an image on imprint material the back in the image-formation equipment which forms a multicolor toner image by once imprinting what imprints directly the toner image formed on image support, and forms an image on imprint material, and the toner image formed on image support on a middle imprint object.

[0005] In the thing of the former direct imprint method, so that it may be indicated by JP,9-288397,A, for example In preparation for the surroundings of image support, a monochrome imaging means is constituted for a developer and image support cleaning equipment. Two or more the monochrome imaging means were put in order along the imprint material conveyance way, tandem imaging equipment was formed, the monochrome toner image was formed with each monochrome imaging means of the tandem imaging equipment, those monochrome toner images were directly imprinted from each image support, and the synthetic toner image was formed on imprint material.

[0006] In the thing of the latter indirect imprint method, the rotary mold developer was used for the monochrome imaging means, the monochrome toner image was serially formed on image support with the rotary mold developer, the sequential imprint of the monochrome toner image was carried out, the synthetic toner image was formed on the middle imprint object, the synthetic toner image was imprinted and the multi-colored picture image was formed on imprint

material so that it might be indicated by this official report.

[0007]

[Problem(s) to be Solved by the Invention] By the way, the social request which asks for the toner which maintenance and saving-resources-izing of social environment are strongly desired, and is used with image formation equipment carrying out recycle use from a viewpoint on ecology in recent years is also becoming large. Moreover, by carrying out recycle use, the consumption of a toner can be reduced substantially and a maintenance cost can be lowered.

[0008] For this reason, in the conventional image formation equipment mentioned above, what equips a monochrome imaging means with the toner recycle equipment which conveys to a developer the toner collected with image support cleaning equipment is increasing.

[0009] Also with the image formation equipment which forms a monochrome toner image, or the image formation equipment which forms a multicolor toner image, however, in the case of a direct imprint method Since imprint material contacts image support directly, if foreign matters, such as paper powder, waste, etc. adhering to imprint material, will transfer to image support, the foreign matter will mix into the toner collected with image support cleaning equipment and recycle use is carried out There was a problem to which it enters into a recycle toner and image quality falls.

[0010] In the case of an indirect imprint method, since imprint material does not contact image support directly, there is such no problem. However, with the conventional configuration which is indicated by JP,9-288397,A mentioned above, when it was going to carry out recycle use of each color toner, the image support cleaning equipment only for [each] colors was formed, it must stop having had to establish the device which moreover attaches and detaches them to image support, the configuration was complicated very much, and there was a problem that implementation was almost difficult.

[0011] For this reason, it was also being presupposed to what is indicated by this JP,9-288397,A that recycle use only of the black toner is carried out.

[0012] Then, the 1st purpose of this invention is in the image formation equipment which forms a synthetic toner image to enable recycle use of the toner according to individual, preventing mixing of the foreign matter to a recycle toner, and preventing deterioration of image quality.

[0013] The 2nd purpose is in color picture formation equipment to attain such a purpose.

[0014] The toner in which the 3rd purpose does not have fear of color mixture in color picture formation equipment is to carry out recycle use as much as possible.

[0015] while the 4th purpose prevents mixing of the foreign matter to a recycle toner and prevents deterioration of image quality in the image formation equipment which forms a synthetic toner image — recycle of black with little image deterioration — it is in supposing that it is usable.

[0016] In color picture formation equipment, even if it carries out color mixture of the 5th purpose, it is to make it there be no toner deterioration as much as possible.

[0017] The 6th purpose is in 2 color image formation equipment to attain such a purpose.

[0018] The 7th purpose is in the multi-colored picture image formation equipment of the type whose image support is a drum and whose middle imprint object is a belt to attain the 1st purpose.

[0019] The 8th purpose has [both] image support and a middle imprint object in attaining the 1st purpose in the multi-colored picture image formation equipment of the type which is a belt.

[0020] The 9th purpose is in the image formation equipment which forms a synthetic toner image to attain the 1st purpose, improving maintenance nature.

[0021] The 10th purpose is in the monochrome imaging means of the image formation equipment which forms a synthetic toner image to enable recycle use of an individual toner, preventing mixing of the foreign matter to a recycle toner, and preventing deterioration of image quality.

[0022] The 11th purpose is in the toner recycle equipment of the image formation equipment which forms a synthetic toner image to enable recycle use of an individual toner, preventing mixing of the foreign matter to a recycle toner, and preventing deterioration of image quality.

[0023] The 12th purpose is in the image formation equipment which forms a monochrome toner image to enable recycle use of a toner, preventing mixing of the foreign matter to a recycle

toner, and preventing deterioration of image quality.

[0024] The 13th purpose is in the monochrome image formation equipment of the type whose image support is a drum and whose middle imprint object is a belt or a drum to attain the 12th purpose of the above.

[0025] The 14th purpose is in the monochrome image formation equipment of the type whose image support is a belt and whose middle imprint object is a belt or a drum to attain the 12th purpose of the above.

[0026] The 15th purpose is in monochrome image formation equipment to attain the 12th purpose, improving maintenance nature.

[0027] The 16th purpose is in the monochrome imaging means of monochrome image formation equipment to enable recycle use of a toner, preventing mixing of the foreign matter to a recycle toner, and preventing deterioration of image quality.

[0028] The 17th purpose is in the toner recycle equipment of monochrome image formation equipment to enable recycle use of a toner, preventing mixing of the foreign matter to a recycle toner, and preventing deterioration of image quality.

[0029] The 18th purpose is in image formation equipment to prevent the impurity of being uncharged or low electrification adhering to image support, and prevent deterioration of much more image quality.

[0030] The 19th purpose is in image formation equipment to prevent grinding of the toner by friction and prevent deterioration of much more image quality.

[0031] In image formation equipment, the 20th purpose smooths the shape of surface type of a toner, improves the rate of an imprint of a toner, reduces the amount of recycle toners, prevents deterioration of image quality, and is to prevent deterioration of much more image quality.

[0032] The 21st purpose is set to image formation equipment, in addition loses fluctuation of the component ratio of the toner at the time of toner recycle, prevents deterioration of image quality, and is to prevent deterioration of much more image quality.

[0033] In image formation equipment, the 22nd purpose sticks a middle imprint object to image support, improves the rate of an imprint of a toner, and is to prevent deterioration of much more image quality.

[0034] The 23rd purpose is to attain the 1st or 12th purpose of the above, preventing generating of an after-image without improving the cleaning engine performance and causing deterioration of a middle imprint body surface.

[0035] The 24th purpose is to attain the 1st or 12th purpose of the above, preventing generating of an after-image by reducing the toner adhesion force to a middle imprint object, and improving the cleaning engine performance.

[0036] The 25th purpose is to attain the 1st or 12th purpose of the above, preventing generating of an after-image by raising the mold-release characteristic between a middle imprint body surface and a toner, and improving the cleaning engine performance.

[0037] The 26th purpose is to attain the 1st or 12th purpose of the above, preventing generating of an after-image simply without causing deterioration of a middle imprint body surface, using improvement in the cleaning engine performance as easy.

[0038] The 27th purpose is to attain the 1st or 12th purpose of the above, specifying the length of a middle imprint object, surface migration speed, a dielectric constant, and a volume resistivity, and lessening imprint Chile by low cost.

[0039]

[Means for Solving the Problem] Therefore, that invention concerning claim 1 should attain the 1st purpose mentioned above In preparation for the surroundings of image support, a monochrome imaging means is constituted for a developer and image support cleaning equipment. In image formation equipment which once imprints a toner image formed on image support of the monochrome imaging means on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Put two or more monochrome imaging means in order along the rotation conveyance direction of a middle imprint object, and tandem imaging equipment which forms a multi-colored picture image on a middle imprint object is constituted. It is characterized by thing it comes to have toner recycle equipment which

conveys to a developer a toner collected with image support cleaning equipment for at least two monochrome imaging means among monochrome imaging means to constitute the tandem imaging equipment.

[0040] Invention concerning claim 2 compounds a monochrome image formed with each monochrome imaging means through a middle imprint object in image formation equipment according to claim 1 that the 2nd purpose mentioned above should be attained, and is characterized by thing it comes to form a synthetic color picture on imprint material.

[0041] That the 3rd purpose mentioned above should be attained, in image formation equipment according to claim 2, invention concerning claim 3 is tandem imaging equipment, and is characterized by thing it comes to equip toner recycle equipment with a monochrome imaging means to arrange in a rotation conveyance direction maximum upstream location of a middle imprint object.

[0042] Invention concerning claim 4 is characterized by thing it comes to equip a black monochrome imaging means toner recycle equipment with at least among two or more monochrome imaging means in image formation equipment according to claim 2 that the 4th purpose mentioned above should be attained.

[0043] That the 5th purpose mentioned above should be attained, in image formation equipment according to claim 2, invention concerning claim 5 is tandem imaging equipment, and is characterized by thing it comes to arrange a black monochrome imaging means in the rotation conveyance direction lowest style location of a middle imprint object.

[0044] Invention concerning claim 6 puts in order and establishes two monochrome imaging means along the rotation conveyance direction of a middle imprint object in image formation equipment according to claim 1, compounds the monochrome image formed with those monochrome imaging means through a middle imprint object that the 6th purpose mentioned above should attain, and is characterized by the thing it comes to form 2 color images in imprint material.

[0045] Invention concerning claim 7 is characterized by what image support is a drum and a middle imprint object is a belt in claim 1 thru/or image formation equipment given in any 1 of 6 that the 7th purpose mentioned above should be attained.

[0046] Invention concerning claim 8 is characterized by what both image support and a middle imprint object are belts in claim 1 thru/or image formation equipment given in any 1 of 6 that the 8th purpose mentioned above should be attained.

[0047] That the 9th purpose mentioned above should be attained, invention concerning claim 9 prepares image support at least in claim 1 thru/or image formation equipment given in any 1 of 6, and is characterized by thing it comes to constitute a process cartridge which bundles up to a main part of image formation equipment, and is detached and attached.

[0048] A developer and image support cleaning equipment are constituted in preparation for the surroundings of image support that invention concerning claim 10 should attain the 10th purpose mentioned above. In a monochrome imaging means of image formation equipment which once imprints a toner image formed on the image support on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Among those which put more than one in order along the rotation conveyance direction of a middle imprint object, constitute tandem imaging equipment which forms a multi-colored picture image on a middle imprint object, and constitute the tandem imaging equipment, to at least two things It is characterized by thing it comes to have toner recycle equipment which conveys to a developer a toner collected with image support cleaning equipment.

[0049] In preparation for the surroundings of image support, a monochrome imaging means is constituted for a developer and image support cleaning equipment that invention concerning claim 11 should attain the 11th purpose mentioned above. In toner recycle equipment of image formation equipment which once imprints a toner image formed on image support of the monochrome imaging means on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Put two or more monochrome imaging means in order along the rotation conveyance direction of a middle imprint object, and tandem imaging equipment which forms a multi-colored picture image on a middle imprint object is

constituted. It prepares for at least two monochrome imaging means among monochrome imaging means to constitute the tandem imaging equipment, and is characterized by thing it comes to convey to a developer a toner collected with image support cleaning equipment.

[0050] In preparation for the surroundings of image support, a monochrome imaging means is constituted for a developer and image support cleaning equipment that invention concerning claim 12 should attain the 12th purpose mentioned above. In image formation equipment which once imprints a toner image formed on image support of the monochrome imaging means on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Around a middle imprint object, one monochrome imaging means to form a monochrome image is established on the middle imprint object, and it is characterized by thing it comes to have toner recycle equipment which conveys to a developer a toner collected with image support cleaning equipment at the monochrome imaging means.

[0051] Invention concerning claim 13 is characterized by what image support is a drum and a middle imprint object is a belt or a drum in image formation equipment according to claim 12 that the 13th purpose mentioned above should be attained.

[0052] Invention concerning claim 14 is characterized by what image support is a belt and a middle imprint object is a belt or a drum in image formation equipment according to claim 12 that the 14th purpose mentioned above should be attained.

[0053] That the 15th purpose mentioned above should be attained, in image formation equipment according to claim 12, invention concerning claim 15 prepares image support at least, and is characterized by thing it comes to constitute a process cartridge which bundles up to a main part of image formation equipment, and is detached and attached.

[0054] A developer and image support cleaning equipment are constituted in preparation for the surroundings of image support that invention concerning claim 16 should attain the 16th purpose mentioned above. In a monochrome imaging means of image formation equipment which once imprints a toner image formed on the image support on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material It prepares in the surroundings of a middle imprint object, a monochrome image is formed on the middle imprint object, and it is characterized by thing it comes to have toner recycle equipment which conveys a toner collected with image support cleaning equipment to said developer.

[0055] In preparation for the surroundings of image support, a monochrome imaging means is constituted for a developer and image support cleaning equipment that invention concerning claim 17 should attain the 17th purpose mentioned above. In toner recycle equipment of image formation equipment which once imprints a toner image formed on image support of the monochrome imaging means on a middle imprint object, imprints a toner image on the middle imprint object, and forms an image on imprint material Around a middle imprint object, one monochrome imaging means to form a monochrome image is established on the middle imprint object, and it prepares for the monochrome imaging means, and is characterized by thing it comes to convey to a developer a toner collected with image support cleaning equipment.

[0056] That the 18th purpose mentioned above should be attained, in image formation equipment according to claim 1 or 12, invention concerning claim 18 impresses development bias voltage to a developer at the time of development, and is characterized by thing it comes to form mutual electric field.

[0057] Invention concerning claim 19 is characterized by thing it comes to use a toner containing a release agent in image formation equipment according to claim 1 or 12 that the 19th purpose mentioned above should be attained.

[0058] Invention concerning claim 20 is characterized by thing circularity comes to use 90 or more toners in image formation equipment according to claim 1 or 12 that the 20th purpose mentioned above should be attained.

[0059] Invention concerning claim 21 is characterized by thing it comes to use a toner whose half-value width is below $2.2 [fC / 10 \text{ micrometers}]$ in a distribution curve of (amount of electrifications of toner)/(toner particle size) in image formation equipment according to claim 1 or 12 that the 21st purpose mentioned above should be attained.

[0060] Invention concerning claim 22 is characterized by thing it comes to prepare an elastic

layer in a middle imprint object in image formation equipment according to claim 1 or 12 that the 22nd purpose mentioned above should be attained.

[0061] Invention concerning claim 23 is characterized by what it comes to form in the surface of a middle imprint object at homogeneity a toner adhesion force reduction layer which reduces adhesion force of a toner for in image formation equipment according to claim 1 or 12 that the 23rd purpose mentioned above should be attained.

[0062] Invention concerning claim 24 is characterized by thing it comes to form a toner adhesion force reduction layer using zinc stearate in image formation equipment according to claim 23 that the 24th purpose mentioned above should be attained.

[0063] Invention concerning claim 25 is characterized by thing it comes to form a toner adhesion force reduction layer using a fluororesin in image formation equipment according to claim 23 that the 25th purpose mentioned above should be attained.

[0064] Invention concerning claim 26 adheres a particle which uses a brush and it failed to delete from a particle binding object to a middle imprint object in image formation equipment according to claim 23 that the 26th purpose mentioned above should be attained, and is characterized by thing it comes to form a toner adhesion force reduction layer by the adhering particle.

[0065] Invention concerning claim 27 is set to image formation equipment according to claim 1 or 12 that the 27th purpose mentioned above should be attained. Along the rotation conveyance direction of a middle imprint object from a location which gives a charge to the surface of the middle imprint object When distance to a location which moves a toner on the middle imprint object is set to L_0 , surface migration speed of the middle imprint object, a volume resistivity, and specific inductive capacity are set to V_L , ρV , and ϵ , respectively and the dielectric constant of vacuum is set to ϵ_0 , It is characterized by what is become as $L_0 - \frac{V_L}{\rho V - \epsilon_0}$.

[0066] Invention concerning claim 28 is set to image formation equipment according to claim 1 that the 27th purpose mentioned above should be attained. A location which imprints a toner image on image support on a middle imprint object is made into a primary imprint location. Distance between shortest primary imprint locations in an adjoining primary imprint location is set to L_1 along the rotation conveyance direction of a middle imprint object. When surface migration speed of the middle imprint object, a volume resistivity, and specific inductive capacity are set to V_L , ρV , and ϵ , respectively and the dielectric constant of vacuum is set to ϵ_0 , it is characterized by what is become as $L_1 - \frac{V_L}{\rho V - \epsilon_0}$.

[0067] Invention concerning claim 29 is set to image formation equipment according to claim 27 that the 27th purpose mentioned above should be attained. A location which imprints a toner image on image support on a middle imprint object is made into a primary imprint location. And when a location which imprints a toner image on a middle imprint object to imprint material is made into a secondary imprint location and distance from a primary imprint location of the lowest style to a secondary imprint location is set to L_2 along the rotation conveyance direction of a middle imprint object, it is characterized by what is become as $L_2 - \frac{V_L}{\rho V - \epsilon_0}$.

[0068] Invention concerning claim 30 is set to image formation equipment according to claim 27 that the 27th purpose mentioned above should be attained. A location which imprints a toner image on a middle imprint object to imprint material is made into a secondary imprint location. And a location which removes a residual toner on a middle imprint object with middle imprint object cleaning equipment after an imprint is made into a middle imprint object cleaning location in the secondary imprint location. When distance from a secondary imprint location to a middle imprint object cleaning location is set to L_3 along the rotation conveyance direction of a middle imprint object, it is characterized by what is become as $L_3 - \frac{V_L}{\rho V - \epsilon_0}$.

[0069] Invention concerning claim 31 is set to image formation equipment according to claim 27 that the 27th purpose mentioned above should be attained. A location which removes a residual toner on a middle imprint object with middle imprint object cleaning equipment after an imprint is made into a middle imprint object cleaning location in a secondary imprint location. And when a location which imprints a toner image on image support on a middle imprint object is made into a

primary imprint location and distance from a middle imprint object cleaning location to a primary imprint location of the maximum upstream is set to L_4 along the rotation conveyance direction of a middle imprint object, it is characterized by what is become as $L_4 - \sqrt{V \cdot \epsilon}$.

[0070]

[Embodiment of the Invention] Hereafter, it explains per gestalt of implementation of this invention, referring to a drawing. Drawing 1 shows the gestalt of 1 implementation of this invention, and is a whole outline block diagram in a color copying machine.

[0071] The feed table on which the sign 100 in drawing puts the main part of a copying machine, and 200 puts it, the scanner which attaches 300 on the main part 100 of a copying machine, and 400 are manuscript automatic transferring machines (ADF) further attached on it.

[0072] The endless belt-like middle imprint object 10 is established in the center at the main part 100 of a copying machine. As shown in drawing 2, the middle imprint object 10 builds the base layer 11 with a pile material to the mileage of a fluororesin, sail cloth, etc., and forms the elastic layer 12 on it. The elastic layer 12 is built with a fluororubber, acrylonitrile-swine JIEN copolymerization rubber, etc. The surface of the elastic layer 12 coats for example, fluorine system resin, and comes to cover it in the good coat layer 13 of smooth nature.

[0073] And in the example of illustration, a time is hung and carried out to three support rollers 14-15-16, and rotation conveyance is enabled at the clockwise rotation in drawing as shown in drawing 1.

[0074] In this example of illustration, the middle imprint object cleaning equipment 17 from which the residual toner which remains on the middle imprint object 10 after an image imprint is removed on the left of the support roller 15 of [2nd] three is formed.

[0075] Moreover, on the middle imprint object 10 stretched and passed between the 1st support roller 14 of three, and the 2nd support roller 15, along the conveyance direction, four monochrome imaging means 18 of black cyanogen Magenta Hierro are arranged side by side horizontally, and tandem imaging equipment 20 is constituted.

[0076] Now, as shown in drawing 1, on tandem imaging equipment 20, an aligner 21 is formed further.

[0077] On the other hand, on both sides of the middle imprint object 10, a tandem imaging equipment 20 and opposite side is equipped with secondary imprint equipment 22. Secondary imprint equipment 22 builds over and constitutes the secondary imprint belt 24 which is an endless belt from an example of illustration between two rollers 23, through the middle imprint object 10, it is pressed against the 3rd support roller 16, and it arranges it, and imprints the image on the middle imprint object 10 to imprint material.

[0078] The anchorage device 25 established in the transfer picture on imprint material is formed beside secondary imprint equipment 22. An anchorage device 25 presses and constitutes the pressurization roller 27 to the fixing belt 26 which is an endless belt.

[0079] It comes to also prepare the imprint material conveyance function to convey the imprint material after an image imprint to this anchorage device 25 for the secondary imprint equipment 22 mentioned above. Of course, a non-contact charger may be arranged as secondary imprint equipment 22, and, in such a case, it becomes difficult to have this imprint material conveyance function collectively.

[0080] In addition, in the example of illustration, the bottom of such secondary imprint equipment 22 and an anchorage device 25 is equipped with the imprint material turnover device 28 which reverses imprint material to both sides of imprint material that an image should be formed in parallel with the tandem imaging equipment 20 mentioned above.

[0081] Now, when taking a copy using this color copying machine now, a manuscript is set on the manuscript base 30 of the manuscript automatic transferring machine 400. Or the manuscript automatic transferring machine 400 is opened, a manuscript is set on the contact glass 32 of a scanner 300, and the manuscript automatic transferring machine 400 is closed, then it presses down.

[0082] And when the non-illustrated start switch was pushed, a manuscript is conveyed, it moves to up to contact glass 32, when a manuscript is set in the manuscript automatic

transferring machine 400 and a manuscript is set on contact glass 32 the back, a scanner 300 is driven immediately and it runs the 1st transit object 33 and the 2nd transit object 34. And while discharging light from the light source with the 1st transit object 33, the reflected light from a manuscript side is reflected further, and it reflects by the mirror of the 2nd transit object 34 towards the 2nd transit object 34, reads through the image formation lens 35, and puts into a sensor 36, and the contents of a manuscript are read.

[0083] Moreover, if a non-illustrated start switch is pushed, the rotation drive of one of the support rollers 14-15-16 will be carried out with a non-illustrated drive motor, follower rotation of other two rollers will be carried out, and rotation conveyance of the middle imprint object 10 will be carried out. To coincidence, the image support 40 is rotated with each monochrome imaging means 18, and the monochrome image of Black Hierro Magenta cyanogen is formed on each image support 40 at it, respectively. And with conveyance of the middle imprint object 10, the sequential imprint of those monochrome images is carried out, and a synthetic color picture is formed on the middle imprint object 10.

[0084] On the other hand, if a non-illustrated start switch is pushed, selection rotation of one of the feed rollers 42 of the feed table 200 will be carried out, and it lets out imprint material from one of the sheet paper cassettes 44 with which the paper bank 43 is equipped in multistage, one sheet dissociates at a time with the separation roller 45, and it puts into the feed way 46, it conveys with the conveyance roller 47, leads to the feed way 48 within the main part 100 of a copying machine, and dashes and stops to the resist roller 49.

[0085] Or the feed roller 50 is rotated and it lets out the imprint material on a detachable tray 51, and one sheet dissociates at a time with the separation roller 52, and it puts into the manual paper feed way 53, and, similarly dashes and stops on the resist roller 49. A form, an OHP film, etc. are used as imprint material.

[0086] And timing is doubled with the synthetic color picture on the middle imprint object 10, the resist roller 49 is rotated, imprint material is sent in between the middle imprint object 10 and secondary imprint equipment 22, it imprints with secondary imprint equipment 22, and a color picture is formed on imprint material.

[0087] It conveys with secondary imprint equipment 22, and sends into an anchorage device 25, and heat and a pressure are applied with an anchorage device 25, the imprint material after an image imprint is established, and the back, a transfer picture is switched by the change over pawl 55, and is discharged with the discharge roller 56, and it carries out a stack on a paper output tray 57. Or it switches by the change over pawl 55, and puts into the imprint material turnover device 28, and it is reversed there, and leads to an imprint location again, an image is formed also in a rear face, and it discharges on a paper output tray 57 with the discharge roller 56 the back.

[0088] On the other hand, the middle imprint object 10 after an image imprint is middle imprint object cleaning equipment 17, removes the residual toner which remains on the middle imprint object 10 after an image imprint, and equips the image formation for the second time by tandem imaging equipment 20 with it.

[0089] Now, in the tandem imaging equipment 20 mentioned above, in detail, each monochrome imaging means 18 becomes in preparation for the surroundings of the drum-like image support 40 about electrification equipment 60, 61 or primary developer imprint equipment 62, image support cleaning equipment 63, an electric discharger 64, etc., as shown in drawing 3. Although the image support 40 has the shape of a drum which applied the organic photo conductor which has photosensitivity to element tubes, such as aluminum, and formed the sensitization layer in them in the example of illustration, it may be an endless belt-like.

[0090] Although an illustration abbreviation is carried out, the image support 40 is formed at least, a process cartridge is formed in all or a part of portions which constitutes the monochrome imaging means 18, it bundles up to the main part 100 of a copying machine, and maintenance nature may be made to improve as attachment and detachment being free.

[0091] Among the portions which constitute the monochrome imaging means 18, electrification equipment 60 is built with the example of illustration in the shape of a roller, and is charged in the image support 40 by contacting the image support 40 and impressing voltage.

[0092] Although a 1 component developer may be used for a developer 61, in the example of illustration, the two component developer which consists of a magnetic carrier and a nonmagnetic toner is used for it. And it constitutes from the stirring section 66 which conveys stirring the two component developer and adheres to the development sleeve 65, and the development section 67 which transfers the toner of the two component developers adhering to the development sleeve 65 to the image support 10, and let the stirring section 66 be a low location from the development section 67.

[0093] Two parallel screws 68 are formed in the stirring section 66. Between two screws 68, it divides with a diaphragm 69 except for both ends (refer to drawing 6). Moreover, the toner concentration sensor 71 is attached in the development case 70.

[0094] On the other hand, while countering the development section 67 with the image support 40 through the opening of the development case 70 and forming the development sleeve 65 in it, a magnet 72 is fixed and formed in the development sleeve 65. Moreover, the development sleeve 65 is approached in a tip, and a doctor blade 73 is formed. In the example of illustration, the gap in the closest-approach section between a doctor blade 73 and the development sleeve 65 is set as 500 micrometers.

[0095] And conveyance circulation is carried out stirring 2 component developer by two screws 68, and the development sleeve 65 is supplied. The developer supplied to the development sleeve 65 is pumped up with a magnet 72, is held, and forms a magnetic brush on the development sleeve 65. The ear end of the magnetic brush is carried out with a doctor blade 73 with rotation of the development sleeve 65 at a proper amount. The cut-off developer is returned to the stirring section 66.

[0096] On the other hand, among the developers on the development sleeve 65, a toner is transferred to the image support 40 with the development bias voltage impressed to the development sleeve 65, and forms the electrostatic latent image on the image support 40 into a visible image. After the formation of a visible image, the developer which remained on the development sleeve 65 separates from the development sleeve 65 in the place which does not have the magnetism of a magnet 72, and returns to the stirring section 66. By this repeat, if the toner concentration in the stirring section 66 becomes thin, it will be detected by the toner concentration sensor 71, and toner supply will be carried out at the stirring section 66.

[0097] Incidentally, in the example of illustration, linear velocity of 200 mm/s and the development sleeve 65 is made into 240 mm/s for the linear velocity of the image support 40. A development stroke is performed [diameter] in the diameter of 50mm and the development sleeve 65, using the diameter of the image support 40 as 18mm. The amount of toner electrifications on the development sleeve 65 is the range of $-10 \sim -30 \mu\text{C/g}$. The development gap GP which is the gap of the image support 40 and the development sleeve 65 can aim at improvement in development effectiveness by being able to set up in [conventional] 0.8 to 0.4mm, and making a value small.

[0098] Thickness of the image support 40 is set to 30 micrometers, the diameter of the beam spot of optical system is set to 50x60 micrometers, and the quantity of light is set to 0.47mW. Moreover, development bias voltage is made into -470V , development potential 350V [i.e.,], using -700V and the exposure afterpotential VL as -120V for the electrification (before exposure) potential V0 of the image support 40, and a development production process is performed.

[0099] Next, primary imprint equipment 62 is made into the shape of a roller, and is pressed and formed in the image support 40 on both sides of the middle imprint object 10. Independently, you may be not only the shape of a roller but a non-contact charger.

[0100] Image support cleaning equipment 63 contacts the image support 40 in a periphery, and is equipped with the conductive fur brush 76 in the **** direction free [rotation] while it presses a tip against the image support 40, for example, is equipped with the cleaning blade 75 made of a polyurethane rubber. Moreover, it has the metal electric-field roller 77 which impresses bias to the fur brush 76 in the **** direction free [rotation], and the tip of a scraper 78 is pressed against the electric-field roller 77. Furthermore, the recovery screw 79 which collects the removed toners is formed.

[0101] And the fur brush 76 which rotates in the direction of a counter to the image support 40 removes the residual toner on the image support 40. The toner adhering to the fur brush 76 is removed with the electric-field roller 77 which rotates in the direction of a counter to the fur brush 76, and impresses bias. The electric-field roller 77 is cleaned with a scraper 78. By the recovery screw 79, the toner collected with image support cleaning equipment 63 is brought near by one side of image support cleaning equipment 63, with the toner recycle equipment 80 mentioned later in detail, is returned to a developer 61 and reused.

[0102] An electric discharger 64 is a lamp, irradiates light and initializes the surface potential of the image support 40.

[0103] And with rotation of the image support 40, the surface of the image support 40 is first charged uniformly with electrification equipment 60, the write-in light L by laser, LED, etc. is irradiated from the aligner 21 subsequently mentioned above according to the contents of read of a scanner 300, and an electrostatic latent image is formed on the image support 40.

[0104] Then, a toner is adhered with a developer 61, the electrostatic latent image is formed into a visible image, and the visible image is imprinted on the middle imprint object 10 with primary imprint equipment 62. The surface of the image support 40 after an image imprint removes and cleans a residual toner with image support cleaning equipment 63, discharges it with an electric discharger 64, and image formation for the second time is equipped with it.

[0105] Drawing 4 is the important section enlarged view of the color copying machine shown in drawing 1. In this drawing, after each sign of each image support 40 of each monochrome imaging means 18 of tandem imaging equipment 20, and its monochrome imaging means 18, each developer 61, each image support cleaning equipment 63, and the each primary imprint equipment 62 that counters the image support 40 of each monochrome imaging means 18, respectively, and is formed in it respectively — Black's case — BK — in the case of Hierro, in the case of a Magenta, M is attached, in the case of cyanogen, C is attached, and Y is shown.

[0106] With the tandem imaging equipment 20 of the example of illustration, the monochrome imaging means 18 is arranged from the upstream in order of Hierro, cyanogen, a Magenta, and Black to a lower stream of a river along the hand of cut of the middle imprint object 10 as this drawing 4 shows. Thus, if black monochrome imaging means 18BK is arranged in the lowest style location, even if the toner on the middle imprint object 10 will transfer on image support 40C, color mixture cannot be conspicuous and recycle use of the toner can be carried out.

[0107] And it is good to equip with toner recycle equipment 80 a monochrome imaging means 18 to arrange especially in the rotation conveyance direction maximum upstream location of the middle imprint object 10, and it good for monochrome imaging means 18BK of black with little [at least] toner deterioration to have toner recycle equipment 80. [that what is necessary is just to equip at least two monochrome imaging means 18 with toner recycle equipment 80 in this invention] However, it comes to prepare toner recycle equipment 80 for all the monochrome imaging means 18 in the example of illustration.

[0108] The toner recycle equipment 80 is shown in drawing 5 and drawing 6. The roller section 82 which has a pin 81 at the end is formed in the recovery screw 79 of image support cleaning equipment 63 as shown in drawing 5. And the 1 side of the belt-like recovery toner conveyance member 83 of toner recycle equipment 80 is hung on the roller section 82, and a pin 81 is put into it at the long hole 84 of the recovery toner conveyance member 83. It comes to prepare a wing 85 in the periphery of the recovery toner conveyance member 83 every fixed gap, in addition a side is hung on the roller section 87 of the axis of rotation 86.

[0109] The recovery toner conveyance member 83 is put in in the conveyance way case 88 shown in drawing 6 with the axis of rotation 86. The conveyance way case 88 is built to a cartridge case 89 and one, and it comes to put one of two screws 68 which the developer 61 mentioned above into the edge by the side of the developer 61.

[0110] And while transmitting driving force from the exterior and rotating the recovery screw 79, rotation conveyance of the recovery toner conveyance member 83 is carried out, the toner collected with image support cleaning equipment 63 is conveyed to a developer 61 through the inside of the conveyance way case 88, and it puts in in a developer 61 by rotation of a screw 68. Then, conveyance circulation is carried out stirring with the developer which are two screws 68

and is already in a developer 61, the development sleeve 65 is supplied, the ear end is carried out with a doctor blade 73, the back, a rearrangement is carried out to the image support 40, and the latent image on the image support 40 is developed as mentioned above.

[0111] In the example of illustration, since a monochrome imaging means 18 to constitute a developer 61 and image support cleaning equipment 63 in preparation for the surroundings of the image support 40 is equipped with the toner recycle equipment 80 which conveys the toner collected with image support cleaning equipment 63 to a developer 61 in the image formation equipment which forms a color picture, recycle use of each color toner can be enabled.

[0112] Moreover, in accordance with the middle imprint object 10, put two or more monochrome imaging means 18 in order, and tandem imaging equipment 20 is constituted. A synthetic toner image is formed on the middle imprint object 10 with the tandem imaging equipment 20. Since the synthetic toner image is imprinted and an image is formed on imprint material (i.e., since it imprints through the middle imprint object 10 and an image is formed on imprint material), it is made for imprint material not to contact the image support 40 directly. Foreign matters, such as paper powder, waste, etc. adhering to the imprint material, can prevent mixing to a recycle toner, and can prevent deterioration of image quality.

[0113] In addition, it depends for the rate of an imprint on resistance greatly. Generally imprint material has high hygroscopicity and its resistance fluctuation to environmental variations, such as temperature and humidity, is large. On the other hand, the middle imprint object 10 mainly has resistance fluctuation of as opposed to [using the big thing of resistance in many cases] an environmental variation smaller than imprint material, such as a resin material. Then, if an indirect imprint is carried out through the middle imprint object 10 and an image is formed on imprint material like the example of illustration mentioned above, resistance fluctuation to an environmental variation can be lessened compared with the direct imprint method directly imprinted to imprint material, and the rate of an imprint can be stabilized.

[0114] In addition, the example of illustration mentioned above explained the case where it applied to the color copying machine which forms a monochrome image with each monochrome imaging means 18, compounds those monochrome images and forms a synthetic color picture in imprint material.

[0115] However, this invention puts in order and establishes not only color picture formation equipment but two monochrome imaging means 18. Also to 2 color image formation equipment which forms a monochrome image with those monochrome imaging means 18, imprints those monochrome images through a middle imprint object, and forms 2 color images in imprint material. By equipping each monochrome imaging means 18 with the toner recycle equipment 63 which conveys the toner collected with image support cleaning equipment 63 to a developer 61, it can apply similarly and the same effect can be acquired.

[0116] A toner mixes an electrification control agent (CCA) and a coloring material to resin, such as polyester, polyol, and a styrene acrylic, and the electrification property and a fluidity are raised by ~~**~~(ing) material, such as a silica and titanium oxide, outside around it. The ranges of the particle size of an additive are usually 0.1–1.5 [μm]. A coloring material can raise carbon black, copper phthalocyanine blue, Quinacridone, carmine, etc. Electrification polarity is negative electrification in the example of illustration.

[0117] A toner can use what is ~~**~~(ing) the additive of the above-mentioned class outside for the parent toner which carried out distributed mixing of the wax etc. Although a toner is created by the grinding method by the explanation so far, what was created by the polymerization method etc. is usable. As for the toner generally created by the polymerization method, the heating method, etc., it becomes to form a shape factor to 90% or more, and the coverage of the additive by the configuration also becomes very higher still.

[0118] Here, properly speaking [a shape factor], it serves as a degree of sphericity, is defined by "a particle, and surface area $\times 100\%$ of the surface area / real particle of the ball of this volume", but since measurement becomes quite difficult, it is computed by circularity. The definition carries out to projection outline length $\times 100\%$ of "the perimeter / real particle" with the same projected area as a particle of a circle. It will approach to 100%, so that the projected circle will approach a perfect circle, if it does so.

[0119] 3–12 micrometers is suitable for the range of the volume mean particle diameter of a toner, it is referred to as 6 micrometers in the example of illustration, and it can be enough dealt also with the image of the high resolution of 1200 or more dpi.

[0120] A magnetic particle uses a metal or resin as a core, magnetic materials, such as a ferrite, are contained, and a surface is covered with silicon resin etc. The range of particle size of 20–50 micrometers is good. Moreover, the range of resistance of 104–106ohm is the optimal at dynamic resistance. However, a measuring method is the measured value when supporting on the roller ($\phi 20; 600\text{RPM}$) which connoted the magnet, making the electrode of width of face of 65mm, and length 1mm area contact by gap 0.9mm, and impressing the applied voltage of resisting pressure maximum level (several [A high resistance silicon coat carrier 400 V to an iron powder carrier] V).

[0121] The development sleeve 65 has the configuration of the nonmagnetic shape of a pivotable sleeve, and is arranging two or more magnets 72 in the interior. A magnet 72 is made to act magnetism when a developer passes through a predetermined location, since it is fixed. in the example of illustration, the diameter of the development sleeve 65 is set to $\phi 18$, the surface performs processing which forms two or more slots which have sandblasting or a depth of 1–several mm, and it goes into the range of 10–30micromRZ — as — oh, it is carrying out.

[0122] A magnet 72 has five magnetic poles of N1, S1, N2, S2, and S3 in the hand of cut of the development sleeve 65 from the part of a doctor blade 73. it forms with a magnet 72 — having had (toner + magnetic particle) — it is supported on the development sleeve 65 as a developer, and a toner obtains the regular amount of electrifications by being mixed with a magnetic particle. In the example of illustration, the range of $-10\text{—}30[\mu\text{C/g}]$ is suitable. The development sleeve 65 counters the image support 40, and is arranged in the field by the side of 72 magnetS1 in which the magnetic brush of a developer was formed.

[0123] By the way, while forming tandem imaging equipment 20 in multi-colored picture image formation equipment above, the case where it had toner recycle equipment 80 was explained. However, in the case of monochrome image formation equipment, as shown in drawing 7, it constitutes. In drawing 7, the same sign is attached and duplication explanation is abbreviated to having given the corresponding point of the example mentioned above.

[0124] With the monochrome image formation equipment shown in drawing 7, in preparation for the surroundings of the image support 40, the monochrome imaging means 18 is constituted for a developer 61 and image support cleaning equipment 63, a toner image is formed on the image support 40 using the monochrome imaging means 18, the toner image is once imprinted on the middle imprint object 10, the back, the toner image on the middle imprint object 10 is imprinted, and a monochrome image is formed on imprint material.

[0125] The monochrome imaging means 18 is equipped with the toner recycle equipment 80 which conveys the toner collected with image support cleaning equipment 63 to a developer 61. Like the example mentioned above, toner recycle equipment 80 is constituted, as shown in drawing 5 and drawing 6.

[0126] Although the image support 40 is a drum and the middle imprint object 10 is a belt in the example shown in this drawing 7, as shown in drawing 8, the middle imprint object 10 is good also as a drum. This drawing 8 also attaches the same sign and abbreviates duplication explanation to having given the corresponding point of the example mentioned above. In addition, the image support 40 is also good not only as a drum but a belt similarly.

[0127] Moreover, similarly, the image support 40 may be formed at least and the process cartridge which bundles up to the main part of image formation equipment, and is detached and attached may consist of examples shown in these drawing 7 and drawing 8.

[0128] Next, it explains in full detail below about the development bias voltage impressed to a developer 61 at the time of development.

[0129] As shown in a developer 61 in illustration at drawing 9, the development sleeve 65 is formed. And the oscillating bias voltage which superimposed alternating voltage on direct current voltage as development bias voltage according to the power supply 90 is impressed to the development sleeve 65 at the time of development. Background potential and image section potential are located between the maximum of the above-mentioned oscillating bias voltage, and

the minimum value. Of this, the mutual electric field from which the sense changes by turns are formed in the development section A. And the toner and magnetic particle of a developer vibrate violently in this mutual electric field, swing OFF flies the development sleeve 65 and the electrostatic restraint to a magnetic particle to the image support 40, and a toner adheres corresponding to the latent image of the image support 40.

[0130] The difference (voltage between peaks) of the maximum of oscillating bias voltage and the minimum value has desirable 0.5–5kV, and is [frequency] desirable. [of 1–10kHz] A square wave, a sine wave, a triangular wave, etc. can be used for the wave of oscillating bias voltage. The direct-current-voltage component of oscillating bias is a value between background potential and image section potential, as described above, but its direction which is a value near [potential / image section] background potential is desirable when preventing adhesion of the fogging toner to a background potential field.

[0131] When the wave of oscillating bias voltage is a square wave, it is desirable to make a duty ratio into 50% or less. Here, a duty ratio is the rate of time amount that a toner tends to go to the image support 40 in 1 period of oscillating bias voltage. Since the difference of the peak value and the time average value of bias with which a toner tends to go to the image support 40 by doing in this way can be enlarged, movement of a toner can activate further, a toner can adhere in potential distribution of a latent image side faithfully, and a feeling of a rough deposit and resolution can be raised.

[0132] Moreover, with a toner, since the magnetic particle which has the charge of reversed polarity can make small the difference of the peak value and the time average value of bias which are going to go to the image support 40, movement of a carrier can be calmed down and the probability for a magnetic particle to adhere to the background of a latent image can be reduced sharply. Moreover, even if the impurity of being un-charged or low electrification exists, negatives are not developed, but image quality can be maintained, without image deterioration occurring, since it does not adhere to the image support 40.

[0133] Next, the toner used with a developer is explained below.

[0134] A release agent is contained in a toner. As a release agent, a polyolefine WA@KKUSU (polyethylene wax, polypropylene wax, etc.); long-chain hydrocarbons (paraffin WA@KKUSU, SAZORU wax, etc.); carbonyl group content wax etc. is mentioned. A thing desirable [among these] is a carbonyl group content wax. as a carbonyl group content wax — poly alkane acid ester (carnauba wax —) A montan wax, trimethylol propane tribehenate, pentaerythritol tetra-behenate, Pentaerythritol diacetate dibehenate, glycerine tribehenate, ; poly alkanol ester (a trimellitic acid tris RISUTE allyl compound —), such as 1 and 18-OKUTA decane diol distearate ; poly alkane acid amides, such as distearyl maleate (ethylenediamine dibehenyl amide etc.); poly alkylamide (trimellitic acid tris TEARIRU amide etc.);, dialkyl ketones (distearyl ketone etc.), etc. are mentioned.

[0135] A desirable thing is poly alkane acid ester among these carbonyl group content waxes. The melting point of the wax of this invention is usually 40–160 degrees C, and is 60–90 degrees C still more preferably 50–120 degrees C preferably. The wax with which a less than 40-degree C wax has a bad influence on heat-resistant shelf life, and the melting point exceeds 160 degrees C is a lifting and a cone about cold offset at the time of fixing at low temperature. Moreover, as measured value in a temperature higher 20 degrees C than the melting point, 5–1000cps is desirable still more desirable, and the dissolution viscosity of a wax is 10–100cps. The wax exceeding 1000cps is deficient in the hot-proof offset nature and low-temperature fixable improvement effect. The content of the wax in a toner is 0 – 40 usual % of the weight, and is 3 – 30 % of the weight preferably.

[0136] If a toner is made to contain a release agent, oilless fixing will be attained by making a toner release from mold, without applying release agents, such as a silicone oil, with an anchorage device 25. Moreover, when a wax exists in the outside of toner resin, so to speak, the duty of lubricant is achieved. Toner resin itself is not ground by contact to a cleaning member by this effect, either, without hurting. Incidentally, with the wax non-added toner, when the quality assurance test with the passage of time by the existence of a wax was carried out, although the toner deteriorated in 190K sheets, whenever [condensation] rose, development capacity fell

and image quality deteriorated, with the toner of carnauba wax 3wt% content, without a toner deteriorating to 250K sheets, recycle was able to be continued and image quality was able to be maintained.

[0137] Next, a toner configuration is explained below.

[0138] What was created by the grinding method and the polymerization method can be used for a toner. The toner created by this method can smooth the surface, and it is possible for a shape factor, i.e., circularity, to create 90% or more of toner. Generally a conglobation toner can express the index with a degree of sphericity. A degree of sphericity falls as it becomes a grinding toner, using a true ball as 1.

[0139] If circularity of the image projected in the degree of sphericity is set to SR, it can be defined as $SR = (\text{boundary length of boundary-length} / \text{particle projection image of circle of same area as particle projected area}) \times 100\%$, and will become such a value near 100% that a toner is close to a true ball.

[0140] The effect of conglobation of a toner is explained as compared with the conventional grinding mold (indeterminate form) toner. Toner B (this example) is titanium oxide 0.7wt% silica 0.5wt% similarly to Toner A (silica 0.2wt% and titanium oxide 0.3wt%) conventionally. One of the main functions of an additive is preventing lowering the cohesive force of toners and a toner serving as an aggregate, changing it into "the condition of having unfolded", if possible, and acquiring uniform development and an imprint property. When the rate of adhering to the surroundings of a parent toner is considered by coverage, since Toner B is close to a globular form, as compared with Toner A, its surface area is conventionally small at this time. The part and the coverage by the additive of Toner B increase, and development capacity increases that it is easy to move in the development sleeve 65 top because a fluidity improves. If circularity uses 90 or more toners, when the surface becomes smooth, the rate of an imprint will improve and the value of 92% in the rate of an imprint will be acquired to 88% with the conventional grinding toner. Since the amount of recycle toners decreases "Swerve" and it is hard coming to win popularity the effect of toner grinding at the time of recycle etc., an image does not deteriorate.

[0141] Next, the distribution curve of (amount of electrifications of toner)/(toner particle size) is explained below.

[0142] The particle size of the toner on the development sleeve 65 and the amount distribution of electrifications are measured. In measurement, it is E-SPART by Hosokawa Micron CORP. ANALYZER was used. This E-SPART Although detailed explanation of ANALYZER is omitted, air is sprayed and flown to the toner on the development sleeve 65, and the particle size of toner each in catching the motion in electric field and the data of the amount of electrifications can be obtained. Incidentally, in this check experiment, 3000 toners were sampled and the difference of distribution was seen. Moreover, distribution of q/d which mainly ~~was~~ (ed) the amount of electrifications of a toner with toner particle size is compared here. This comes from the amount of electrifications being dependent on the particle size of a toner.

[0143] The toner used in the example has the optimal toner which created the polyester by which conversion was carried out by the dry type toner and polymerization method which are contained as a toner binder at least. What used the former toner is explained. The shape factor of a toner is $SF=95\%$. Then, when this particle size of the toner on a development sleeve and the amount distribution of electrifications are measured in first stage, the amount distribution of electrifications is Sharp so that it may be shown drawing 10. And the half-value width was 1.1 [$\mu\text{C} / 10 \text{ micrometers}$].

[0144] Generally, the index about sharpness is expressed with half-value width, and its one where the value is smaller is sharp. Generally many toners which have q/d of a near value with distribution being sharp will exist, and uniform development can be attained from development capacity being the same. Since the range of the amount of toner electrifications which exists on the contrary if distribution serves as broadcloth spreads also in the range of breadth and development capacity, while fluctuation of the amount of development will arise, if the amount side of low electrifications increases, it will become easy to generate a greasing.

[0145] Next, when asked for the same half-value width after recycle, it was 1.7 [$\mu\text{C} / 10$

micrometers]. Furthermore, when the value after recycle was measured by the system which used the common grinding toner, it was 2.7 [fC / 10 micrometers]. This is inserted into the blade whose toner's is a cleaning member, and the image support 40 at the time of cleaning, and a toner becomes ground [tend] by the thrust. If it does so, since it adheres to toner with the still more nearly another diameter toner of a granule with the abundance ratio of the toner of the diameter of a granule increasing to mean particle diameter, it becomes in secondary particle and it exists as a diameter toner of a large drop, q/d distribution broadcloth-izes.

[0146] Although the above-mentioned half-value width and the relation of a greasing were shown in drawing 11 , if 2.2 is exceeded, it turns out that the threshold value 0.08 (the difference of the reflection density to the transfer paper non-developed negatives is used as ΔD) of a greasing is exceeded. From this, the greasing property after recycle is falling with the conventional grinding toner. However, if half-value width uses the toner which is 2.2 or less, even if it recycles, sufficient amount of electrifications will be maintained and image quality will not deteriorate.

[0147] Next, elasticity-ization of the middle imprint object 10 is explained below.

[0148] The range of the degree of hardness HS of the middle imprint object 10 is preferably made into $10 \leq HS \leq 60$ degree (JIS-A). Although a degree of hardness is sufficiently low when a belt is used, it may slip in the drive transfer section. If the roller of the rigid body is used to it, the nonuniformity to rotation, i.e., transit, can be decreased extremely. However, if a degree of hardness is too high, a possibility that whenever [by precision / additional coverage] will not stick to narrowing and the image support 40 well will also come out. Then, a degree of hardness is made low by forming the elastic layer 12, flexibility is given to the middle imprint object 10, whenever [with the image support 40 / adhesion additional coverage] tends to be raised, the rate of an imprint tends to be raised, image deterioration tends to be avoided by reducing the amount of recycle toners, and it is going to maintain image quality.

[0149] The thing below degree-of-hardness JIS-A of 10 degrees is very difficult to fabricate with sufficient dimensional accuracy. This originates in it being easy to receive contraction and expansion at the time of molding. Moreover, although it is a general method to make an oil component contain to a base material when making it soft, it has the defect of oozing out if it carries out in the state of pressurization at the time of continuation actuation. It turned out that the toner which ** on the middle imprint object 10 surface is made to pollute by this, and the rate of an imprint falls remarkably.

[0150] On the other hand, since the thing more than degree-of-hardness JIS-A of 60 degrees becomes possible [that it can fabricate with a sufficient part precision for the degree of hardness to have gone up, and stopping an oil content few], the stain resistance to a toner can be reduced. However, since the usable range in consideration of contact pressure narrows, it is necessary to eat and to set up the amount of lumps, or contact pressure correctly. The middle imprint roller A (degree-of-hardness JIS-A of 61 degrees) is compared with the middle imprint roller B (degree-of-hardness JIS-A of 40 degrees) which is an example of this invention, and it explains.

[0151] Drawing 12 makes contact pressure a parameter and is the thing to the degree of hardness and the image support 40 of the middle imprint object 10 which ate and showed the relation of the amount of lumps. It eats. the time of putting in the range of fluctuation of contact pressure within the limits of three to 12 gf/mm with the middle imprint roller A with three to 8 gf/mm, and the middle imprint roller B — the — lump **** 0.02mm, respectively It is set to 0.05mm and dimensional accuracy must be increased about 2.5 times with the middle imprint roller A as compared with the middle imprint roller B.

[0152] Therefore, whenever [additional coverage] spreads [the direction of the type of the middle imprint roller B]. The change of the opening of the image support 40 and the middle imprint object 10 of spread [whenever / additional coverage] decreases, and I think that the rate of an imprint is stabilized. On the contrary, when a degree of hardness is high, it eats, change of the amount of lumps becomes large, and the rate of an imprint falls. As opposed to the conventional middle imprint roller A with a comparatively high degree of hardness (degree-of-hardness JIS-A of 61 degrees) with the middle imprint roller B of this invention (degree-of-

hardness JIS-A of 40 degrees) Since the value of 94% will be acquired with the middle imprint roller B of this invention to 90% in the conventional middle imprint roller A if the rate of an imprint is measured and it is [the amount of recycle of a toner decreases and] hard coming to win popularity the effect of toner grinding at the time of recycle etc., an image does not deteriorate.

[0153] By the way, in the example shown in drawing 13, the fur brush 92 and a cleaning blade 93 are formed in middle imprint object cleaning equipment 17 as a cleaning member. The fur brush 92 is formed so that the middle imprint object 10 may be contacted and it may rotate in the direction of a counter to it. On the other hand, a cleaning blade 93 is the down-stream location of the fur brush 92, and it is prepared so that a tip may be pressed against the middle imprint object 10 in support of a end face. The sign 94 in drawing 13 is the toner conveyance member of the shape of a coiled form or a screw.

[0154] And with rotation of the middle imprint object 10, the secondary transfer residual toner on the middle imprint object 10 is removed by the fur brush 92 and the cleaning blade 93, and the removed toner is conveyed to the waste toner bottle which is not illustrated [for example,] by the toner conveyance member 94.

[0155] Now, the particle binding object 96 is formed in the lower stream of a river of such middle imprint object cleaning equipment 17. Although the particle binding object 96 is what pushed and hardened the particle which consists of zinc stearate, a thing containing a fluororesin, etc., and was formed in the shape of a stick and carries out an illustration abbreviation, it supports a end face with a holder etc., for example, carries out spring energization of the holder etc., and comes to press a tip against the middle imprint object 10.

[0156] And a particle is adhered with the particle binding object 96 with rotation of the middle imprint object 10, and as shown in drawing 14, the toner adhesion force reduction layer 98 which consists of the adhering particle 97 is formed in the surface of the middle imprint object 10. the toner adhesion force reduction layer 98 is uniform — it carries out to a condition, i.e., the maximum nectar restoration condition, further desirably. In addition, the sign 99 in drawing 14 shows the toner which adhered on the middle imprint object 10.

[0157] 0.1–1.0 micrometers of particle diameter are good. If particle diameter becomes large, even if it forms the toner adhesion force reduction layer 98 in homogeneity, a possibility that irregularity will be made and the trap of the toner will be carried out will arise.

[0158] There is a possibility of transferring as the particle binding object 96 presses, the force is not held on the middle imprint object 10 surface, or it adheres to the middle imprint object 10 and it is conveying, after it adheres superfluously as it is shown in drawing 15, when the range of 1 – 20 g/cm is the optimal and exceeds 20 g/cm, and the toner adhesion force reduction layer 98 turns into 2–3 layers and a toner 99 is imprinted. Moreover, contact of the grain child binding object 96 which is less than 1 g/cm, and the middle imprint object 10 becomes an ununiformity, the portion in which the toner adhesion force reduction layer 98 is not formed will occur, and fixing of the toner to the middle imprint object 10 surface will be promoted as a result.

[0159] By the way, in the example of illustration, the particle binding object 96 was adhered to the middle imprint object 10, and the particle 97 of direct push reliance and the particle binding object 96 was adhered to the middle imprint object 10. However, although an illustration abbreviation is carried out, the particle which it failed to delete from the particle binding object 96 using the brush may be made to adhere to the middle imprint object 10.

[0160] The brush to the particle binding object 96 and the middle imprint object 10 eats, and when less than 0.5mm, it becomes impossible in this case, for contact nonuniformity with a brush to become remarkable, if 0.5mm – 2mm is the optimal and exceeds 2mm, respectively, and for the amount of lumps to perform enough adhesion on scraping from the particle binding object 96 by the fall of contact pressure, and the middle imprint object 10 surface.

[0161] Here, the case where zinc stearate is used is explained as a particle 97. Although dispersibility of zinc stearate with a toner is good, it has the electrification property of a toner and reverse and its adhesion force with a toner is also high. A wax material can be raised as a material similar to this. It is based on organic materials, such as carnauba wax and polypropylene.

[0162] That is, since the closest packing of the particle 97 is carried out on the middle imprint object 10 while heightening adhesion force with a toner 99 and ensuring maintenance of the toner 99 on the middle imprint object 10 by using zinc stearate, a possibility that a toner 99 will adhere to the middle imprint object 10 directly is reduced remarkably. furthermore — since the electrification property of zinc stearate is contrary to a toner and the adhesion force of zinc stearate and the middle imprint object 10 decreases at the same time it makes it easy to adhere a toner 99 — the ** toner on the middle imprint object 10 — cleaning equipment 17 — enough — scraping — things are made.

[0163] Next, the case where the thing containing a fluoro-resin is used as a particle 97 is explained.

[0164] A fluoro-resin has a mold-release characteristic to the charge of facing of a toner 99, the middle imprint object 10, and the image support 40. It is raised as a reason that this has the low surface energy of fluorine itself to other materials. Moreover, since the middle imprint object 10 has the high mold-release characteristic, as for a fluoro-resin, it can avoid the toner to the surface, and adhesion of a member.

[0165] As a main material, polytetrafluoroethylene (PTFE) and tetrafluoroethylene-perfluoroalkyl vinyl ether (PFA), a tetrafluoroethylene hexafluoropropylene polymer (FEP), a tetrafluoroethylene hexafluoropropylene copolymer (FEP), a tetrafluoroethylene hexafluoropropylene copolymer (FEP), a polychlorotrifluoroethylene resin (PCTFE), a tetrafluoroethylene ethylene copolymer (ETFE), a chlorotrifluoroethylene ethylene copolymer (ECTFE), poly vinylidene fluoride (PVDF), polyvinyl fluoride (PVF), etc. can be raised. Since content of the combination of these materials or a conductive material is greatly related to the volume of the middle imprint object 10, and the property of surface electrical resistance, it is good to adjust suitably.

[0166] By adoption of a fluoro-resin material, it can be fundamentally charged in reversed polarity with a toner 99, electrostatic adhesion force with a toner 99 can be reduced, it can make it possible to scratch the transfer residual toner which exists on the middle imprint object 10 with cleaning equipment 17, and generating of the after-image in the following image can be prevented.

[0167] Now, the particle binding object 96 mentioned above can press, and the degree of strength can also be enabled.

[0168] For example, as shown in drawing 16, towards the middle imprint object 10, it has a light emitting device 110 and a photo detector 111, the light emitted from the light emitting devices 110, such as photosensor, is reflected on the middle imprint object 10 surface in which the toner **** pattern was formed, it puts into a photo detector 111, concentration is detected, the particle binding object 96 over the middle imprint object 10 presses based on it, and strength is changed.

[0169] Detection timing considers as 5 – 10 times to a length of 29.7cm of the sheet of A4 size, and is taken as the minimum interval of about 3cm. The detection output voltage by the image pattern detected by that cause by drawing 17 is shown. By the halftone image, an output is high and the output is low by the solid image.

[0170] By the halftone image, since the rate of area of a ** toner is low as compared with a solid image, in the contact by the cleaning blade 93, the toner adhesion force reduction layer 98 is easy being scratched more, and it may exfoliate partially.

[0171] Then, when the integral value integrated from the beginning is set as a certain value and the value is reached, the particle binding object 96 presses, and as the force is made to raise from 10g/cm to 15 g/cm and is shown in drawing 18 by about ten-sheet image formation to it, formation of the toner adhesion force reduction layer 98 is promoted. It presses, and it presses and it is good to be greatly dependent on the force and the process linear velocity which described time amount previously, and to optimize by the system.

[0172] By the way, it is good to rotate the middle imprint object 10 at the time of non-image formation, to contact the middle imprint object 10 in the cleaning blade 93 of cleaning equipment 17, to remove the particle adhering to the surface, to press the particle binding object 96 fixed time after that, and to form the uniform toner adhesion force reduction layer 98.

[0173] If the middle imprint object 10 is rotated at the time of non-image formation and the

middle imprint object 10 is contacted in the cleaning blade 93 of cleaning equipment 17, the toner adhesion force reduction layer 98 will exfoliate in about 1 minute. That is because the toner adhesion force reduction layer 98 has only adhered simply, and if it carries out more than it, the middle imprint object 10 surface will get damaged by the interaction with a cleaning blade 93, and it will become tooth-like.

[0174] Then, if the particle binding object 96 is pressed for about 2 minutes, the uniform toner adhesion force reduction layer 98 can be formed. There was an old thing, also when a toner entered between the toner adhesion force reduction layers 98, but if it does in this way, it will become possible to remove a toner from the middle imprint object 10 surface completely. Thereby, cleaning of a transfer residual toner is always ensured and generating of an after-image, fixing, etc. can be prevented.

[0175] Now, it is usually known that the time constant τ in a resistor is expressed with $\tau = (\text{dielectric constant of resistor}) \times (\text{volume resistivity of a resistor})$. This is a time constant in the case of the circuit where the resistance component and capacity component of a resistor were connected to juxtaposition, and a middle imprint object time constant can consider that the above-mentioned circuit is an equal circuit.

[0176] If the potential difference between q and the middle imprint body surface rear face at that time is set to V for the charge accumulated in the belt surface of a middle imprint object in the model of drawing 19 and the displacement current which flows the electrostatic capacity of a middle imprint object to C and Resistance R is set to I , when the formula of the $q = C \cdot V$ (formula 1) (formula 2) $I = V/R$ (formula 3) $I = dq/dt$ above will be arranged, it is $x(1/(C \cdot R)) \cdot dq/dt = 1/(RC)$.

When a next door and this formula are solved by time amount about q , it is $q(\text{formula 5}) (t) = \exp(-t/RC)$.

If it converts into surface potential, it will be set to $V(\text{formula 6}) (t) = \exp(-t/RC) / C$, and will be set to potential difference $1/e$ of the first stage immediately after charging a middle imprint object at the time of $t = RC$ from the above-mentioned relation.

[0177] Time amount until time amount, i.e., middle imprint object upper surface potential, until V declines to $1/e$ descends and the potential difference with inferior-surface-of-tongue potential is set to $1/e$ of an initial state is equivalent to the time constant τ of a middle imprint object, and serves as $\tau = RC$. Since it becomes $0/(C \cdot R)$ (formula 7) $R = \rho \cdot V/d$ of $C = \epsilon_0 \cdot \epsilon_r$ when C and R per unit area set $\rho \cdot V$ and specific inductive capacity to ϵ_0 and set [the thickness of a middle imprint object] the dielectric constant of vacuum to ϵ_0 for d and a volume resistivity, a time constant τ serves as $\tau = \rho \cdot V - \epsilon_0$ (formula 9) $V - \epsilon_0$. Therefore, it turns out that the time constant of the middle imprint object thickness direction is expressed with $\tau = (\text{dielectric constant of middle imprint object}) \times (\text{volume resistivity of a middle imprint object})$.

[0178] Here, suppose that the middle imprint object was charged and the surface was charged under a certain effect. As a factor in which a middle imprint object is charged, electrification by contact to conductive members, such as electrification by discharge or a roller, a board, etc. with the frictional electrification and the corona charger with a certain components, a discharge brush, etc. which constitute a machine, etc. is mentioned. For example, the case where a toner is charged before a secondary imprint, mention Q/M of a toner, and imprint effectiveness is improved, and the case where it is made easy to electrify a secondary transfer residual toner with a corona charger or a conductive roller before middle imprint object cleaning, to arrange polarity, and to clean are applied to this example. In addition, the phenomenon in which that the middle imprint object has coiled around a conductive roller also causes frictional electrification, and a charge takes the surface etc. is observed, and this charge may have caused the poor imprint.

[0179] Thus, electrification of the surface of a middle imprint object poses a big problem at migration of a toner image in the case. Although a toner moves in an operation of electric field, the potential difference with the element tube of a middle imprint object rear face and an opposed face, for example, image support, or rodding of a secondary imprint roller determines the field strength, but the effect is large when the middle imprint body surface is charged.

Moreover, if the middle imprint body surface crossed to the whole surface and is charged in homogeneity, better, electrification nonuniformity has arisen in many cases and a middle imprint body surface will become imprint nonuniformity in a partial portion in that case in fact. Therefore, when between after a middle imprint body surface is charged until it goes into the stroke of the migration of a toner to a degree is set to T_0 , there is little effect which middle imprint object upper surface potential will fully decrease if it is $T_0 < \tau$, and it has on migration of a toner. Since T_0 is expressed as L_0/VL when a middle imprint object sets passing speed of L_0 and a middle imprint body surface to VL for the length of the surface on a middle imprint object after the surface is charged under a certain effect until it starts migration of the following toner, it becomes $L_0/VL < \rho V - \epsilon - \epsilon_0$.

[0180] Here, if the volume resistivity of a middle imprint object, specific inductive capacity, passing speed, and distance are set up as [according to claim 27] this invention so that a formula 10 may be filled, turbulence of the toner image at the time of the imprint by electrification of a middle imprint body surface can be prevented. If the distance between image support in the tandem middle imprint method in the case of repeating a primary imprint and performing it a passage according to claim 28 similarly hereafter is set up, turbulence of the toner image at the time of the imprint by electrification of a middle imprint body surface can be prevented. Similarly, if the distance from the last primary imprint location to a secondary imprint location is set up a passage according to claim 29, turbulence of the toner image at the time of the imprint by electrification of a middle imprint body surface can be prevented. Similarly, if the distance from a secondary imprint location to the cleaning location of a middle imprint object is set up a passage according to claim 30, turbulence of the toner image at the time of the imprint by electrification of a middle imprint body surface can be prevented. If similarly the distance to the primary imprint location of the first amorous glance is set up by claim 31 in order to perform a color pile on a middle imprint object again from the cleaning location of a middle imprint object, turbulence of the toner image at the time of the imprint by electrification of the belt surface can be prevented.

[0181] Here, based on the operation gestalt of drawing 4, the trial calculation of the property for which a middle imprint object is asked is made. Although four image support is in contact with the middle imprint object in drawing 4, it is [all the distance between four image support in this case] equal, and there is $L_1 = 120\text{mm}$. Moreover, the distance from the contact section of the last image support and a middle imprint object to a secondary imprint location is $L_2 = 190\text{mm}$, and $L_3 = 245\text{mm}$ and the cleaning section to the contact section with the first image support of the distance from a secondary imprint location to the cleaning section is $L_4 = 95\text{mm}$.

[0182] Among the above-mentioned conditions, like the publication to claim 27, L of the shortest one is the distance L_4 from the cleaning section to the first image support, and if $L_4/VL > \rho V - \epsilon - \epsilon_0$ is satisfied, the good image should be obtained.

[0183] About drawing 4, the seamless belt which consists of a fluorine system resin sheet (specific inductive capacity $\epsilon = 8$, thickness $= 150\text{micrometer}$, and perimeter $= 1060\text{mm}$) was used as a middle imprint object. When that from which resistance differs this middle imprint object was prepared and volume-resistivity ρV and surface resistivity ρS of a middle imprint object were measured with the Mitsubishi Chemical measuring instrument (trade name: Huy Lester, probe:HRS), one middle imprint objects A were volume-resistivity $\rho V = 1 \times 10^{11}$ to $5 \times 10^{11}\text{-ohmcm}$, and surface resistivity $\rho S = 1 \times 10^9\text{--}1 \times 10^{10}\text{ohm/**}$ (applied voltage: 500V, timer:10 seconds). Moreover, the middle imprint objects B of another side were volume-resistivity $\rho V = 5 \times 10^{12}$ to $1 \times 10^{13}\text{-ohmcm}$, and surface resistivity $\rho S = 5 \times 10^{10}\text{--}1 \times 10^{11}\text{ohm/**}$ (applied voltage: 500V, timer:10 seconds). When it is made for the linear velocity of a middle imprint object to serve as $VL = 360\text{ mm/sec}$ and the working speed of a machine printed the image, it was a comparatively good image with the middle imprint object A, but with the middle imprint object B, the rate of an imprint fell as the rate of a primary imprint was bad and especially the color was piled up. Moreover, the fine spot pattern was seen extensively.

[0184] Here, it is $L_4/VL = 0.26$ in these operation conditions, and is $\rho V - \epsilon - \epsilon_0 = 3.54\text{--}7.1$ with the middle imprint object A in $\rho V - \epsilon - \epsilon_0 = 0.071\text{--}0.354$ and the middle imprint object B. Therefore, with the middle imprint object A, to having been in the condition

specified by outline this invention, it had deviated greatly from under the condition of a publication of this invention, and if the middle imprint object B did not devise a certain policy, it brought a result from which a good image is not obtained.

[0185]

[Effect of the Invention] Since it has toner recycle equipment which conveys to a developer the toner collected with image support cleaning equipment for a monochrome imaging means to constitute a developer and image support cleaning equipment in preparation for the surroundings of image support in the image formation equipment which forms a synthetic toner image according to invention concerning claim 1, recycle use of an individual toner can be enabled as explained above.

[0186] Moreover, in accordance with a middle imprint object, put two or more monochrome imaging means in order, and tandem imaging equipment is constituted. Since a synthetic toner image is formed on a middle imprint object with the tandem imaging equipment, the synthetic toner image is imprinted and an image is formed on imprint material. That is, since it imprints through a middle imprint object and an image is formed on imprint material, as imprint material cannot contact image support directly, it can prevent foreign matters, such as paper powder, waste, etc. adhering to the imprint material, mixing to a recycle toner, and deterioration of image quality can be prevented.

[0187] In addition, it depends for the rate of an imprint on resistance greatly. Generally imprint material has high hygroscopicity and its resistance fluctuation to environmental variations, such as temperature and humidity, is large. On the other hand, a middle imprint object mainly has resistance fluctuation of as opposed to [using the big thing of resistance in many cases] an environmental variation smaller than imprint material, such as a resin material. Then, if an indirect imprint is carried out through a middle imprint object and an image is formed on imprint material like invention concerning claim 1, resistance fluctuation to an environmental variation can be lessened compared with the direct imprint method directly imprinted to imprint material, and the rate of an imprint can be stabilized.

[0188] And according to invention concerning claim 1, tandem imaging equipment is formed, it has a middle imprint object, and those combination can attain the following effects further by having toner recycle equipment.

[0189] 1) Tandem imaging equipment is formed and there is a problem of imprint **** by step-up of imprint voltage in some which imprint directly the toner image formed on image support, and form an image on imprint material. However, by adopting the middle imprint method using a middle imprint object, imprint voltage can be reduced and generating of imprint **** can be prevented.

[0190] 2) adopting the tandem system which formed tandem imaging equipment, although speed will be downed if a middle imprint method is adopted — especially, speed can be raised with multi-colored picture image formation equipment, and productivity can be improved.

[0191] 3) The rate of an imprint can be improved by adopting a middle imprint method, and the amount of recycle toners can be especially reduced with multi-colored picture image formation equipment.

[0192] 4) If toner recycle is adopted with multi-colored picture image formation equipment, especially a waste toner can be reduced and it can contribute to maintenance of social environment.

[0193] According to invention concerning claim 2, such an effect can be attained in color picture formation equipment.

[0194] According to invention concerning claim 3, in the tandem imaging equipment of color picture formation equipment, the effect of the invention concerning above-mentioned claim 1 can be attained, color mixture not being afraid and carrying out [suppose that a monochrome imaging means to arrange in the rotation conveyance direction maximum upstream location of a middle imprint object is equipped with toner recycle equipment, and] recycle use of the toner.

[0195] According to invention concerning claim 4, for a black monochrome imaging means at least, the effect of the invention concerning above-mentioned claim 1 can be attained among two or more monochrome imaging means, enabling recycle use of black with little image

deterioration, since it has toner recycle equipment preventing mixing of the foreign matter to a recycle toner, and preventing deterioration of image quality.

[0196] According to invention concerning claim 5, in the tandem imaging equipment of color picture formation equipment, the effect of the invention concerning above-mentioned claim 1 can be attained, making it there be no toner deterioration as much as possible, since a black monochrome imaging means is arranged in the rotation conveyance direction lowest style location of a middle imprint object, even if it carries out color mixture.

[0197] According to invention concerning claim 6, in 2 color image formation equipment, the effect of the invention concerning above-mentioned claim 1 can be attained.

[0198] According to invention concerning claim 7, in the image formation equipment of the type whose image support is a drum and whose middle imprint object is a belt, the effect of the invention concerning above-mentioned claim 1 can be attained.

[0199] According to invention concerning claim 8, the effect of the invention which requires both image support and a middle imprint object for above-mentioned claim 1 in the image formation equipment of the type which is a belt can be attained.

[0200] According to invention concerning claim 9, in the image formation equipment which forms a synthetic toner image, image support is prepared at least, and the effect of the invention concerning above-mentioned claim 1 can be attained, improving maintenance nature, since the process cartridge collectively detached and attached to the main part of image formation equipment is constituted.

[0201] In the monochrome imaging means of the image formation equipment which forms a synthetic toner image according to invention concerning claim 10 It has toner recycle equipment which conveys to a developer the toner collected with image support cleaning equipment. Since put more than one in order in accordance with a middle imprint object, tandem imaging equipment is constituted, a synthetic toner image is formed on a middle imprint object with the tandem imaging equipment; the synthetic toner image is imprinted and an image is formed on imprint material, the same effect as invention concerning above-mentioned claim 1 can be attained.

[0202] In the image formation equipment which forms a synthetic toner image according to invention concerning claim 11 In accordance with a middle imprint object, put two or more monochrome imaging means in order, and tandem imaging equipment is constituted. It considers as the configuration which forms a synthetic toner image on a middle imprint object with the tandem imaging equipment, imprints the synthetic toner image and forms an image on imprint material. A monochrome imaging means is equipped with toner recycle equipment, and since the toner collected with image support cleaning equipment is conveyed to a developer, the same effect as invention concerning above-mentioned claim 1 can be attained.

[0203] According to invention concerning claim 12, in monochrome image formation equipment, since a monochrome imaging means to constitute a developer and image support cleaning equipment in preparation for the surroundings of image support is equipped with the toner recycle equipment which conveys to a developer the toner collected with image support cleaning equipment, recycle use of a toner can be enabled.

[0204] The toner image on image support is once imprinted on a middle imprint object. Moreover, after, Since the toner image on the middle imprint object is imprinted to imprint material (i.e., since it imprints through a middle imprint object and an image is formed on imprint material), it is made for imprint material not to contact image support directly. Foreign matters, such as paper powder, waste, etc. adhering to the imprint material, can prevent mixing to a recycle toner, and can prevent deterioration of image quality.

[0205] In addition, it depends for the rate of an imprint on resistance greatly. Generally imprint material has high hygroscopicity and its resistance fluctuation to environmental variations, such as temperature and humidity, is large. On the other hand, a middle imprint object mainly has resistance fluctuation of as opposed to [using the big thing of resistance in many cases] an environmental variation smaller than imprint material, such as a resin material. Then, if an indirect imprint is carried out through a middle imprint object and an image is formed on imprint material like invention concerning claim 10, resistance fluctuation to an environmental variation

can be lessened compared with the direct imprint method directly imprinted to imprint material, and the rate of an imprint can be stabilized.

[0206] According to invention concerning claim 13, in the image formation equipment of the type whose image support is a drum and whose middle imprint object is a belt or a drum, the effect of the invention concerning such a claim 12 can be attained.

[0207] According to invention concerning claim 14, in the image formation equipment of the type whose image support is a belt and whose middle imprint object is a belt or a drum, the effect of the invention concerning above-mentioned claim 12 can be attained.

[0208] According to invention concerning claim 15, in monochrome image formation equipment, image support is prepared at least, and the effect of the invention concerning above-mentioned claim 12 can be attained, improving maintenance nature, since the process cartridge collectively detached and attached to the main part of image formation equipment is constituted.

[0209] According to invention concerning claim 16, in the monochrome imaging means of monochrome image formation equipment, since it has toner recycle equipment which conveys to a developer the toner collected with image support cleaning equipment while imprinting the toner image on image support to imprint material through a middle imprint object, the same effect as invention concerning above-mentioned claim 12 can be attained.

[0210] The toner image on image support once imprints on a middle imprint object, according to invention concerning claim 17, a monochrome imaging means equips with toner recycle equipment in monochrome image-formation equipment by considering as the configuration which imprints the toner image on the middle imprint object to imprint material the back, and since the toner which collected with image support cleaning equipment conveys to a developer, the same effect as invention concerning above-mentioned claim 12 can attain.

[0211] According to invention concerning claim 18, in image formation equipment, since development bias voltage is impressed to a developer and mutual electric field are formed at the time of development, in addition to the effect of the invention concerning above-mentioned claims 1 or 12, the oscillating bias voltage which superimposed alternating voltage on direct current voltage can be impressed, it can prevent the impurity of being un-charged or low electrification adhering to image support, and deterioration of much more image quality can be prevented.

[0212] According to invention concerning claim 19, in image formation equipment, since the toner containing a release agent is used, in addition to the effect of the invention concerning above-mentioned claims 1 or 12, grinding of the toner by friction can be prevented and deterioration of much more image quality can be prevented.

[0213] According to invention concerning claim 20, in image formation equipment, since circularity uses 90 or more toners, in addition to the effect of the invention concerning above-mentioned claims 1 or 12, the shape of surface type of a toner is smoothed, the rate of an imprint of a toner is improved, the amount of recycle toners can be reduced, deterioration of image quality can be prevented, and deterioration of much more image quality can be prevented.

[0214] Since the toner whose half-value width is below 2.2 [$fC / 10$ micrometers] is used in the distribution curve of (amount of electrifications of toner)/(toner particle size) in image formation equipment according to invention concerning claim 21 In addition to the effect of the invention concerning above-mentioned claims 1 or 12, a distribution curve can be maintained to Sharp, fluctuation of the component ratio of the toner at the time of toner recycle can be lost, deterioration of image quality can be prevented, and deterioration of image quality can be prevented further.

[0215] According to invention concerning claim 22, in image formation equipment, since an elastic layer is prepared in a middle imprint object, in addition to the effect of the invention concerning above-mentioned claims 1 or 12, a middle imprint object can be stuck to image support, the rate of an imprint of a toner can be improved, and deterioration of much more image quality can be prevented.

[0216] The effect of the invention concerning above-mentioned claims 1 or 12 can be attained preventing an after-image and generating of toner fixing without according to invention concerning claim 23, a toner's not adhering directly, but improving the cleaning engine

performance, and causing deterioration of a middle imprint body surface, since the toner adhesion force reduction layer which reduces the adhesion force of a toner on the surface is formed in homogeneity in a middle imprint object.

[0217] While making it easy to adhere with a toner with the zinc stearate charged in reversed polarity since a toner adhesion force reduction layer is formed using zinc stearate according to invention concerning claim 24 It is made for a toner not to adhere to a direct middle imprint body surface, and the effect of the invention concerning above-mentioned claims 1 or 12 can be attained, preventing an after-image and generating of toner fixing by reducing the toner adhesion force to a middle imprint object, and improving the cleaning engine performance.

[0218] According to invention concerning claim 25, the effect of the invention concerning above-mentioned claims 1 or 12 can be attained, preventing an after-image and generating of toner fixing by raising the mold-release characteristic between a middle imprint body surface and a toner, and improving the cleaning engine performance, since a toner adhesion force reduction layer is formed using a fluororesin.

[0219] The effect of the invention start to above-mentioned claims 1 or 12 can be attained preventing an after-image and generating of toner fixing simply without according to invention concerning claim 26, inviting deterioration of a middle imprint body surface, using improvement in the cleaning engine performance as easy, since the particle which uses a brush and it failed to delete from a particle binding object is adhered to a middle imprint object and a toner adhesion force reduction layer is formed by the adhering particle.

[0220] Even if there is [according to invention concerning claim 27] a case so that the surface of a middle imprint object may be charged under a certain effect in addition to the effect of the invention concerning above-mentioned claims 1 or 12 After that A primary imprint, cleaning of a secondary imprint and a middle imprint object top toner, etc., By the time it reaches the process course which the toner on a middle imprint object moves, the charge on a middle imprint object will be eased, and a good image can be offered, without needing special equipment so that migration of a toner may not be barred.

[0221] According to invention concerning claim 28, it adds to the effect of the invention concerning above-mentioned claims 1 or 12. While a middle imprint object moves to the primary imprint location of a degree from a primary imprint location, the charge which moved to the middle imprint body surface by decreasing to below $1/e$ When it is fully canceled and the potential hysteresis on a middle imprint object imprints a toner image in piles on a middle imprint object, a good image can be offered without needing special equipment so that an image may not be confused or imprint effectiveness may not fall.

[0222] While a middle imprint object moves [according to invention concerning claim 29] from the last primary imprint location which performs a color pile to a secondary imprint location in addition to the effect of the invention concerning above-mentioned claims 1 or 12, the charge which moved to the middle imprint body surface declines to below $1/e$. An image is not confused or imprint effectiveness seems therefore, not to fall, when it is fully canceled and the potential hysteresis on a middle imprint object imprints a toner image from on a middle imprint object to imprint material.

[0223] According to invention concerning claim 30, it adds to the effect of the invention concerning above-mentioned claims 1 or 12. While a middle imprint object moves from a secondary imprint location to a middle imprint object cleaning location, the charge produced in the middle imprint body surface by decreasing to below $1/e$ The potential hysteresis on a middle imprint object is fully canceled, the charge of the residual toner which remained on the middle imprint object on the occasion of the toner image imprint to imprint material fully falls, and the effectiveness of middle imprint object cleaning seems not to fall.

[0224] While a middle imprint object moves [according to invention concerning claim 31] to a primary imprint location from a middle imprint object cleaning location in addition to the effect of the invention concerning above-mentioned claims 1 or 12, the charge which moved to the middle imprint body surface declines to below $1/e$. Electric field seem therefore, not to disturb transition of a toner image, in case it is fully canceled and the potential hysteresis on a middle imprint object imprints a toner image from on image support to up to a middle imprint object.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The gestalt of 1 implementation of this invention is shown and it is a whole outline block diagram in a color copying machine.

[Drawing 2] It is the partial expanded sectional view of the cross-section configuration of the middle imprint object used with the color copying machine.

[Drawing 3] It is the partial expansion block diagram of the DANDEMU imaging equipment used with the color copying machine.

[Drawing 4] It is the important section expansion block diagram of the color copying machine.

[Drawing 5] It is the decomposition perspective diagram of the toner recycle equipment used with the color copying machine.

[Drawing 6] It is a fracture perspective diagram by the side of the developer of the toner recycle equipment.

[Drawing 7] It is the important section block diagram of monochrome image formation equipment.

[Drawing 8] It is the important section block diagram of another monochrome image formation equipment.

[Drawing 9] It is illustration drawing of the developer used by this invention.

[Drawing 10] It is distribution curve drawing of (amount of toner electrifications)/(toner particle size).

[Drawing 11] It is related drawing of the half-value width of the distribution curve, and a greasing.

[Drawing 12] the degree of hardness and image support of a middle imprint object — it eats and is related drawing with the amount of lumps.

[Drawing 13] It is the expansion block diagram of the circumference of the middle imprint object cleaning equipment of another example.

[Drawing 14] It is the partial enlarged view showing the toner adhesion condition to the middle imprint object.

[Drawing 15] It is the partial enlarged view showing another toner adhesion condition to the middle imprint object.

[Drawing 16] It is configuration explanatory drawing of an optical detection means to measure the concentration of the toner **** pattern formed on the middle imprint object.

[Drawing 17] It is drawing showing the detection output voltage by the image pattern.

[Drawing 18] It is drawing showing change of the thickness of a toner adhesion force reduction layer.

[Drawing 19] It is the representative circuit schematic of a middle imprint object.

[Description of Notations]

10 Middle Imprint Object

12 Elastic Layer

13 Coat Layer

17 Middle Imprint Object Cleaning Equipment

18 Monochrome Imaging Means

20 Tandem Imaging Equipment
22 Secondary Imprint Equipment
40 Image Support
61 Developer
63 Image Support Cleaning Equipment
80 Toner Recycle Equipment
92 Fur Brush
93 Cleaning Blade
96 Particle Binding Object
97 Particle
98 Toner Adhesion Force Reduction Layer
99 Toner
100 Main Part of Copying Machine (Main Part of Image Formation Equipment)
110 Light Emitting Device
111 Photo Detector

[Translation done.]

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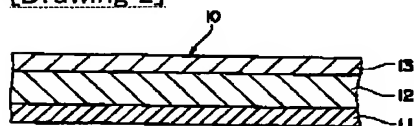
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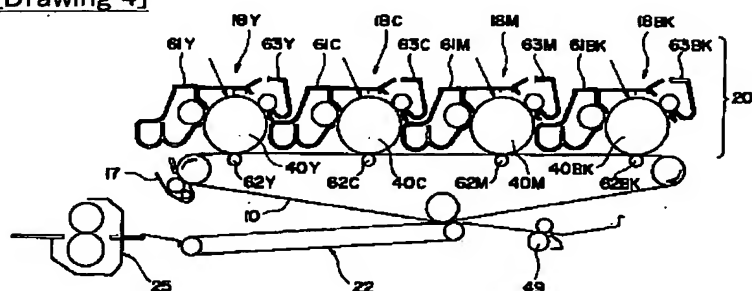
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DRAWINGS

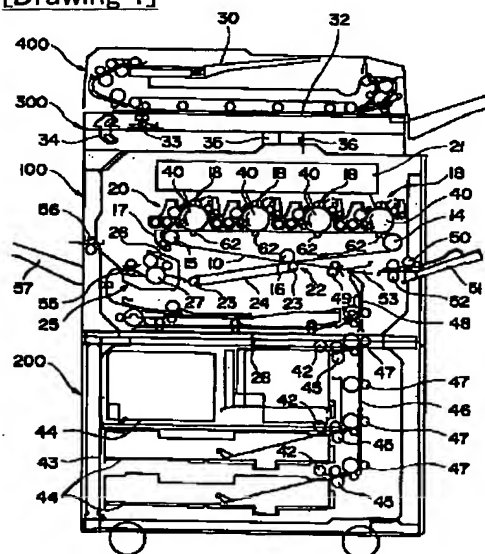
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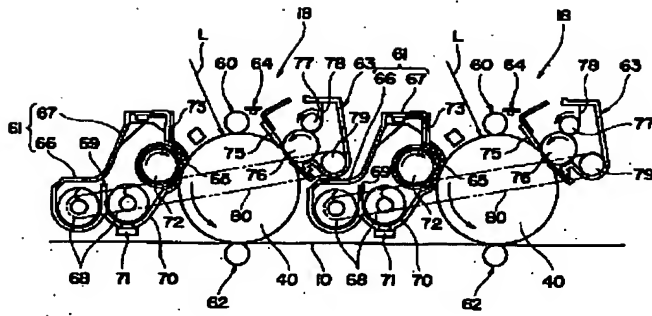
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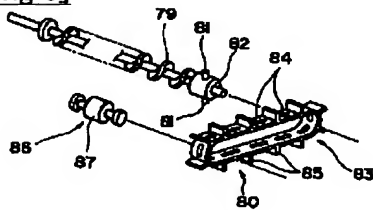
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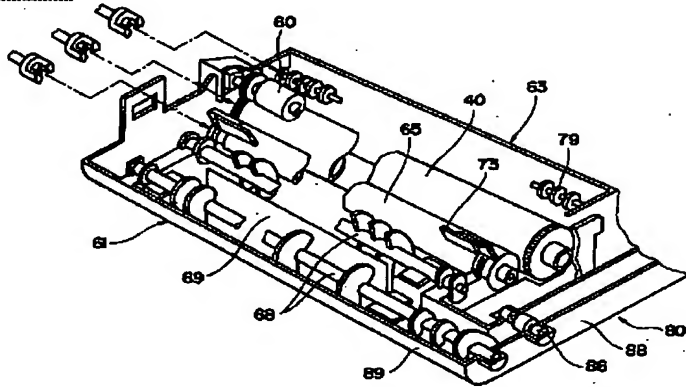
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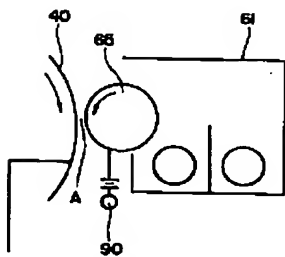
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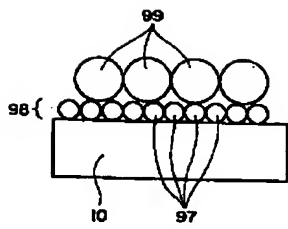
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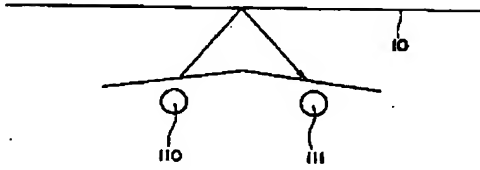
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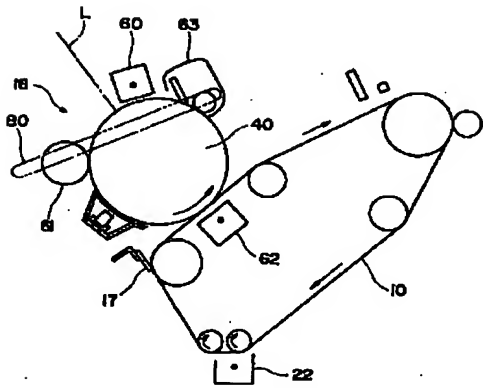
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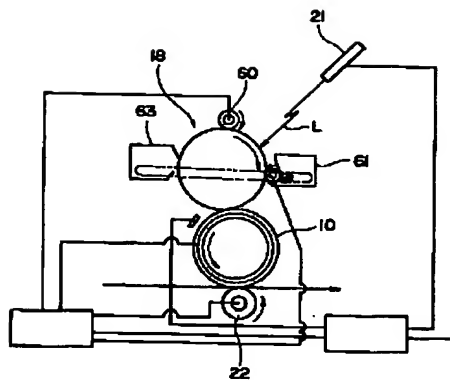
[Drawing 16]



[Drawing 7]

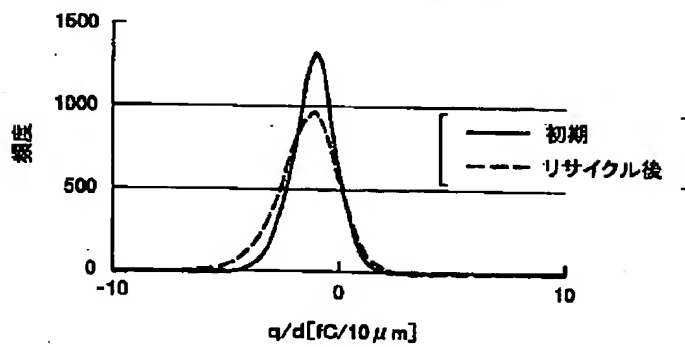


[Drawing 8]

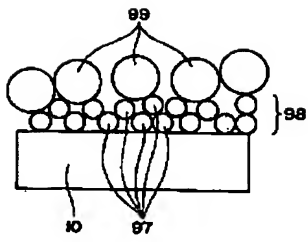


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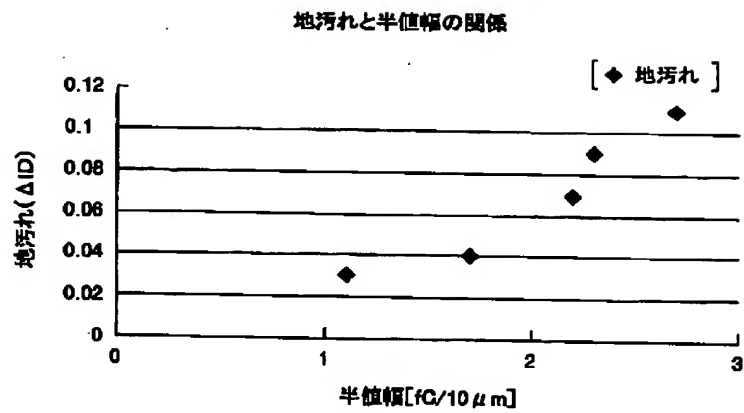
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初期とリサイクル後の比較



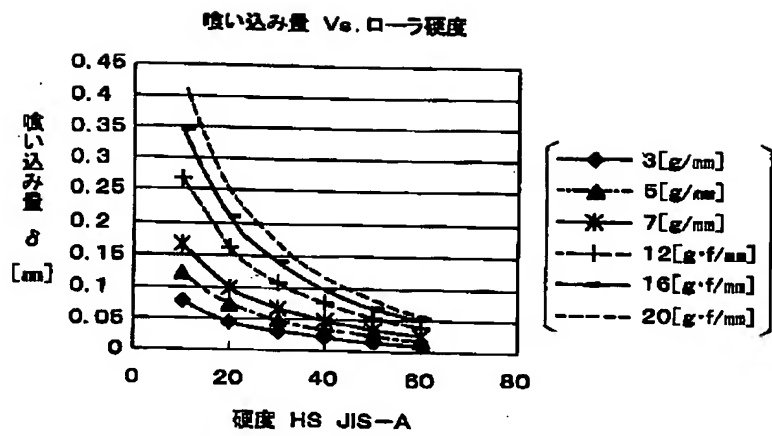
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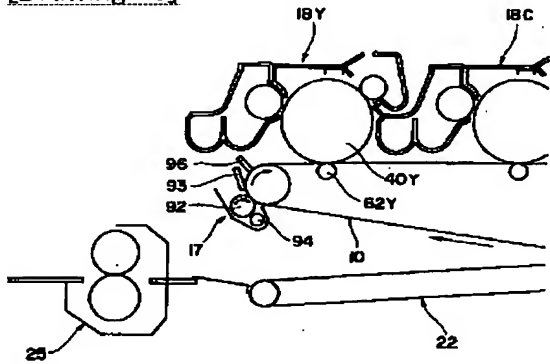
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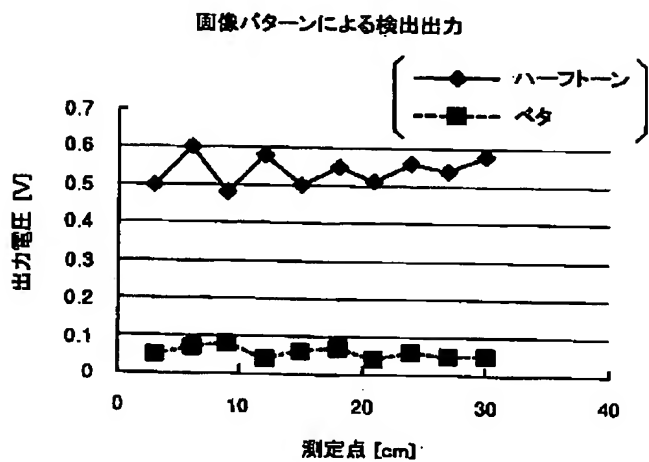
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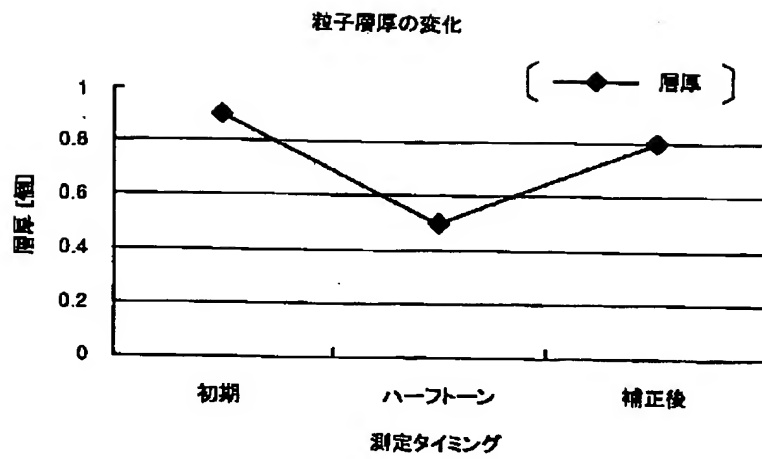
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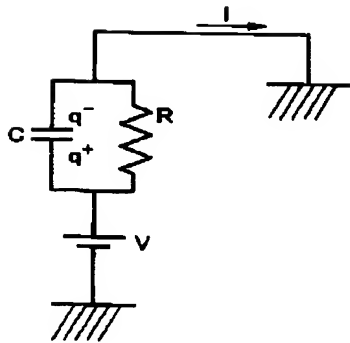
[Drawing 17]



[Drawing 18]



[Drawing 19]



[Translation done.]

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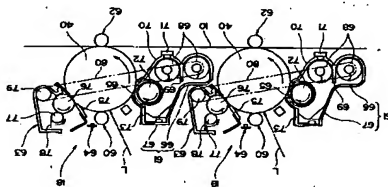
(5) Int.Cl. G 03 G 15/01	識別記号 114 365 101	P.I. G 03 G 15/01 114A 2H030 9/08 365 2H077 15/06 101 2H134	サブコード(参考) L 2H005 114A 2H030 2H073 365 2H077 101 2H134
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(54) 【発明の名称】 画像形成装置、それに備える単色作像手段、およびそれに備えるトナーリサイクル装置

(57) 【要約】

【課題】 画像形成装置において、リサイクルトナーへの異物の混入を防いで画像品質の低下を防止しながら、個別トナーのリサイクル使用を可能とする。

【解決手段】 像担持体40のまわりに、現像装置61や像担持体クリーニング装置63などを備えて単色作像手段18を構成する。そのような単色作像手段を、ベルト状の中間転写体10の回転搬送方向に沿って複数個に並べてタンデム作像装置を構成し、そのタンデム作像装置で中間転写体上に合成トナー画像を形成し、その合成トナー画像を転写して転写材上に多色画像を記録する。タンデム作像装置を構成する単色作像手段のうち少なくとも2つの単色作像手段に、像担持体クリーニング装置63で回収したトナーを現像装置61へと搬送するトナーリサイクル装置80を備える。



【特許請求の範囲】

【請求項1】 像担持体のまわりに現像装置と像担持体クリーニング装置とを備えて単色作像手段を構成し、その単色作像手段の像担持体上に形成したトナー画像をいったん中間転写体に転写し、その中間転写体上のトナー画像を転写して転写材上に画像を形成する、画像形成装置において、

前記中間転写体の回転搬送方向に沿って前記単色作像手段を複数並べて、前記中間転写体上に多色画像を形成するタンデム作像装置を構成し、そのタンデム作像装置を構成する前記単色作像手段のうち少なくとも2つの単色作像手段に、前記像担持体クリーニング装置で回収したトナーを前記現像装置へと搬送するトナーリサイクル装置を備えてなる、画像形成装置。

【請求項2】 個々の前記単色作像手段で形成した単色画像を、前記中間転写体を介して合成して転写材上に合成カラー画像を形成してなる、請求項1に記載の画像形成装置。

【請求項3】 前記タンデム作像装置で、前記中間転写体の回転搬送方向最上流位置に配置する単色作像手段には、前記トナーリサイクル装置を備えてなる、請求項2に記載の画像形成装置。

【請求項4】 複数の前記単色作像手段のうち、少なくとも1つの単色作像手段には、前記トナーリサイクル装置を備えてなる、請求項2に記載の画像形成装置。

【請求項5】 前記タンデム作像装置で、前記中間転写体の回転搬送方向最下流位置に黒の単色作像手段を配置してなる、請求項2に記載の画像形成装置。

【請求項6】 前記中間転写体の回転搬送方向に沿って前記単色作像手段を2つ並べて設け、それらの単色作像手段で形成した単色画像を、前記中間転写体を介して合成して転写材上に2色画像を形成してなる、請求項1に記載の画像形成装置。

【請求項7】 前記像担持体がドラムであり、前記中間転写体がベルトである、請求項1ないし6のいずれか1に記載の画像形成装置。

【請求項8】 前記像担持体および前記中間転写体とともにベルトである、請求項1ないし6のいずれか1に記載の画像形成装置。

【請求項9】 少なくとも前記像担持体を設け、画像形成装置本体に対して一括して着脱するプロセスカートリッジを構成してなる、請求項1ないし6のいずれか1に記載の画像形成装置。

【請求項10】 像担持体のまわりに現像装置と像担持体クリーニング装置とを備えて構成し、その像担持体上に形成したトナー画像をいったん中間転写体に転写し、その中間転写体上のトナー画像を転写して転写材上に画像を形成する、画像形成装置の単色作像手段において、前記中間転写体の回転搬送方向に沿って複数並べて、前記中間転写体上に多色画像を形成するタンデム作像装置

を構成し、そのタンデム作像装置を構成するものうち少なくとも2つのものに、前記像担持体クリーニング装置で回収したトナーを前記現像装置へと搬送するトナーリサイクル装置を備えてなる、画像形成装置の単色作像手段。

【請求項11】 像担持体のまわりに現像装置と像担持体クリーニング装置とを備えて単色作像手段を構成し、その単色作像手段の像担持体上に形成したトナー画像をいったん中間転写体に転写し、その中間転写体上のトナー画像を転写して転写材上に画像を形成する画像形成装置のトナーリサイクル装置において、

前記中間転写体の回転搬送方向に沿って前記単色作像手段を複数並べて、前記中間転写体上に多色画像を形成するタンデム作像装置を構成し、そのタンデム作像装置を構成する前記単色作像手段のうち少なくとも2つの単色作像手段に備え、前記像担持体クリーニング装置で回収したトナーを前記現像装置へと搬送してなる、画像形成装置のトナーリサイクル装置。

【請求項12】 像担持体のまわりに現像装置と像担持体クリーニング装置とを備えて単色作像手段を構成し、その単色作像手段の像担持体上に形成したトナー画像をいったん中間転写体に転写し、その中間転写体上のトナー画像を転写して転写材上に画像を形成する、画像形成装置において、

前記中間転写体のまわりに、その中間転写体上にモノクロ画像を形成する単色作像手段を1つ設け、その単色作像手段に、前記像担持体クリーニング装置で回収したトナーを前記現像装置へと搬送するトナーリサイクル装置を備えてなる、画像形成装置。

【請求項13】 前記像担持体がドラムであり、前記中間転写体がベルトまたはドラムである、請求項12に記載の画像形成装置。

【請求項14】 前記像担持体がベルトであり、前記中間転写体がベルトまたはドラムである、請求項12に記載の画像形成装置。

【請求項15】 少なくとも前記像担持体を設け、画像形成装置本体に対して一括して着脱するプロセスカートリッジを構成してなる、請求項12に記載の画像形成装置。

【請求項16】 像担持体のまわりに現像装置と像担持体クリーニング装置とを備えて構成し、その像担持体上に形成したトナー画像をいったん中間転写体に転写し、その中間転写体上のトナー画像を転写して転写材上に画像を形成する、画像形成装置の単色作像手段において、前記中間転写体のまわりに設けてその中間転写体上にモノクロ画像を形成し、前記像担持体クリーニング装置で回収したトナーを前記現像装置へと搬送するトナーリサイクル装置を備えてなる、画像形成装置の単色作像手段。

【請求項17】 像担持体のまわりに現像装置と像担持

リサイクル使用を可能とすることにある。

【0024】第13の目的は、像担持体がドラムであり、中間転写体がベルトまたはドラムであるタイプの単色画像形成装置において、上記第12の目的を達成することにある。

【0025】第14の目的は、像担持体がベルトであり、中間転写体がベルトまたはドラムであるタイプの単色画像形成装置において、上記第12の目的を達成することにある。

【0026】第15の目的は、単色画像形成装置において、メンテナンス性を向上しながら、第12の目的を達成することにある。

【0027】第16の目的は、単色画像形成装置の単色作像手段において、リサイクルトナーへの異物の混入を防いで画像品質の低下を防止しながら、トナーのリサイクル使用を可能とすることにある。

【0028】第17の目的は、単色画像形成装置のトナーリサイクル装置において、リサイクルトナーへの異物の混入を防いで画像品質の低下を防止しながら、トナーのリサイクル使用を可能とすることにある。

【0029】第18の目的は、画像形成装置において、加えて、未帯電や低帯電の不純物が像担持体に付着することを防いで一層の画像品質の低下を防止することにある。

【0030】第19の目的は、画像形成装置において、加えて、摩擦によるトナーの粉砕を防いで一層の画像品質の低下を防止することにある。

【0031】第20の目的は、画像形成装置において、加えて、トナーの裏面形状を滑らかとしてトナーの転写率を向上し、リサイクルトナー量を低減して画質の劣化を防ぎ、一層の画像品質の低下を防止することにある。

【0032】第21の目的は、画像形成装置において、加えて、トナーリサイクル時におけるトナーの成分比の変動をなくして画質の劣化を防ぎ、一層の画像品質の低下を防止することにある。

【0033】第22の目的は、画像形成装置において、像担持体に中間転写体を密着してトナーの転写率を向上し、一層の画像品質の低下を防止することにある。

【0034】第23の目的は、クリーニング性能を向上して、中間転写体表面の劣化を招くことなく、残像の発生を防止しながら、上記第1または第12の目的を達成することにある。

【0035】第24の目的は、中間臨写体に対するトナ
ー付着力を低減してクリーニング性能を向上することに
より、残像の発生を防止しながら、上記第1または第1
2の目的を達成することにある。

【0036】第25の目的は、中間転写体表面とトナーとの間の離型性を高めてクリーニング性能を向上することにより、残像の発生を防止しながら、上記第1または

的を達成すべく、請求項1ないし6のいずれか1に記載の画像形成装置において、像担持体がドラムであり、中

問転写体がベルトである、ことを特徴とする。

【0046】請求項8に係る発明は、上述した第8の目的を達成すべく、請求項1ないし6のいずれか1に記載の画像形成装置において、像担持体および中間転写体がともにベルトである、ことを特徴とする。

【0047】請求項9に係る発明は、上述した第9の目的を達成すべく、請求項1ないし6のいずれか1に記載の画像形成装置において、少なくともとも像担持体を設け、画像形成装置本体に対して一活して着脱するプロセスカートリッジを構成してなることを特徴とする。

【0048】請求項10に係る発明は、上述した第10の目的を達成すべく、像担持体のまわりに現像装置と像担持体クリーニング装置とを備えて構成し、その像担持体上に形成したトナー画像をいったん中間転写体上に転写すべく、その中間転写体上のトナー画像を転写して転写体上に画像を形成する、画像形成装置の単色作像手段において、中間転写体の回転増速方向に沿って複数並べて、中間転写体上に多色画像を形成するタンデム作像装置を構成し、そのタンデム作像装置を備えるもののうち少なくとも2つのものに、像担持体クリーニング装置で回収したトナーを現像装置へと搬送するトナーリサイクル装置を備えてなる、ことを特徴とする。

【0049】請求項11に係る発明は、上述した第11の目的を達成すべく、像担持体と主として画像装置と像担持体クリップ装置とを備えて単色画像装置を構成している。その単色画像装置の像担持体上に形成したトナー画像を、いったん中間写像体に転写し、その中間写像体上のトナー画像を転写して転写材上に画像を形成する画像形成装置を有するトナー画像形成装置を構成する。中間写像体の回転搬送方向に沿って単色画像手を模倣並べて、中間写像体上に多数色画像を形成するタンデム画像装置を構成し、そのタンデム画像装置を構成する単色画像手段のうち少なくとも2つの単色画像手段が備え、像担持体クリップ装置で回取したトナー画像を画像装置へと搬送してなる、ことを特徴とする。

【0050】請求項12に係る説明は、上述した第12の目的を達成すべく、像担持体のまわりに現像装置と像担持体クリーニング装置とを備えた単色作像手段としたトナー面像をいったん中間転写体に転写し、その中間転写体上のトナー面像を転写して転写材上に面像を形成する、画像トナー面像を転写して転写材上に面像を形成する、画像形成装置において、中間転写体のまわりに、その中間転写体上にモノクロ面像を形成する単色作像手段を1つ設置し、その単色作像手段に、像担持体をロータリーサイクル装置で回転させながら、トナー面像を現像装置へと搬送する、ことを特徴とする。

【0051】請求項13に係る発明は、上述した第13の目的を達成すべく、請求項12に記載の画像形成装置

において、像担持体がドラムであり、中間転写体がベルトまたはドラムである、ことを特徴とする。

【0052】請求項14に係る発明は、上述した第14の目的を達成すべく、請求項12に記載の画像形成装置において、像担持体がペルトであり、中間転写体がペルトまたはドラムである、ことを特徴とする。

【0053】請求項15に係る発明は、上述した第15の目的を達成すべく、請求項12に記載の画像形成装置において、少なくとも像担持体を設け、画像形成装置本体に対して一括して着脱するプロセスカトリッジを構成してなることを特徴とする。

【0054】請求項16に係る発明は、上述した第16図の目的を達成すべく、像担持体のまわりに現像装置と像担持体クリンニング装置とを用いて構成し、その像担持体表面上に形成したトナー画像をいったん中間転写体上を転写し、その中間転写体上をトナー画像を転写して転写材上に画像を形成する、画像形成装置の単色作画手段において、中間転写体のまわりに設け、その中間転写体上にモノクロ画像を形成し、像担持体クリンニング装置で回収したトナーを前記現像装置へ搬送するトナーリサイクル装置を備える、ことを特徴とする。

【0055】請求項17に係る発明は、上述した第17の目的を達成すべく、像担持体のまわりに現像装置と像担持体クリーニング装置とを回して単色作像手段を構成した装置と、その単色作像手段の像担持体に形成したトナー画像をいったん中間写体上に転写し、その中間写体上に備えつけたトナー画像を転写して転写材上に画像を形成する、画像形成装置のトナーリサイクル装置において、中間転写体のまわりに、その中間転写体上にモノクロ画像を形成する単色作像手段を1つ設け、その単色作像手段に備え、像担持体クリーニング装置で回ったトナーを現象装置へと搬送してなる、ことと特徴とする。

【0056】請求項18に係る発明は、上述した第18の目的を達成すべく、請求項1または12に記載の画像形成装置において、現像時に、現像装置に現像パイプアス電圧を印加して交互電界を形成してなる、ことを特徴とする。

【0057】請求項19に係る発明は、上述した第19の目的を達成すべく、請求項1または12に記載の画像形成装置において、離型剤を含有するトナーを使用する、ことを特徴とする。

【0058】請求項20に係る発明は、上述した第20の目的を達成すべく、請求項1または12に記載の画像形成装置において、円形度が90以上のトナーを使用し得る、ことを特徴とする。

【0059】請求項21に係る発明は、上述した第21の目的を達成すべく、請求項1または12に記載の画像形成装置において、(トナーの帯電量)/(トナー粒子径)の分布曲線において半値幅が $2.2[fC/10\mu m]$ 以下であるトナーを使用してなる、ことを特徴とする。

の単色画像を形成する。そして、中間転写体10の搬送とともに、それらの単色画像を順次転写して中間転写体10上に合成カラー画像を形成する。

【0084】一方、不図示のスタートスイッチを押すと、給紙テーブル2000の給紙ローラ42の1つを逆回転し、ペーパーバンク43に多段に備える給紙カセット44の1つから転写材を取り出し、搬送ローラ45で1枚ずつ分離して給紙路46に入れ、搬送ローラ47で搬送して複写機本体100内の給紙路48に導き、レジストローラ49に突き当てて止める。

【0085】または、給紙ローラ50を回転して手差しトレイ51上の転写材を繰り出し、分離ローラ52で1枚ずつ分離して手差し給紙路53に入れ、同じレジストローラ49に突き当てて止める。転写材としては、用紙やOHPフィルム等を用いる。

【0086】そして、中間転写体10上の合成カラー画像にタイミンクを合わせてレジストローラ49を回転し、中間転写体10と2次転写装置22との間に転写材を送り込み、2次転写装置22で転写して転写材上にカラー画像を形成する。

【0087】画像転写後の転写材は、2次転写装置22で搬送して定着装置25へと送り込み、定着装置25で熱と圧力を加えて転写画像を定着した後、切欠爪55で切り換えて排出口ローラ56で排出し、排紙トレイ57上にスタックする。または、切欠爪55で切り換えて転写材反転装置28に入れ、そこで反転して再び転写位置へと導き、裏面にも画像を形成した後、排出口ローラ56で排紙トレイ57上に排出する。

【0088】一方、画像転写後の中間転写体10は、中間転写体クリーニング装置17で、画像転写後に中間転写体10上に残留する残留トナーを除去し、タンデム作像装置20にて残留する残留トナーを除去し、タンデム作像装置20により再度の画像形成に備える。

【0089】さて、上述したタンデム作像装置20において、個々の単色作像手段18は、詳しくは、例えば図3に示すように、ドラム状の像担持体40のまわりに、帯電装置60、現像装置61、1次転写装置62、像担持体クリーニング装置63、除電装置64などを備えてなる。像担持体40は、図示例では、アルミニウム等の葉面に、感光性を有する有機感光体を塗布し、感光層を形成したドラム状であるが、無端ベルト状であってもよい。

【0090】図示省略するが、少なくとも像担持体40を設け、単色作像手段18を構成する部分の全部または一部でプロセスカートリッジを形成し、複写機本体100に対して一括して着脱自在としてメンテナンス性を向上させるようにしてもよい。

【0091】単色作像手段18を構成する部分のうち、帯電装置60は、図示例ではローラ状につくり、像担持体40に接触して電圧を印加することによりその像担持体40の帯電を行う。

【0075】また、3つのうちの第1の支持ローラ14と第2の支持ローラ15間に張り渡した中間転写体10上には、その搬送方向に沿って、ブラック・シアン・マゼンタ・イエロの4つの単色作像手段18を横に並べて配置してタンデム作像装置20を構成する。

【0076】さて、図1に示すように、タンデム作像装置20の上には、さらに露光装置21を設ける。

【0077】一方、中間転写体10を按んでタンデム作像装置20と反対の側には、2次転写装置22を備える。2次転写装置22は、図示例では、2つのローラ23間に、無端ベルトである2次転写ベルト24を掛け渡して構成し、中間転写体10を介して第3の支持ローラ16に押し当てて配置し、中間転写体10上の画像を転写材に転写する。

【0078】2次転写装置22の端には、転写材上の転写画像を定着する定着装置25を設ける。定着装置25は、無端ベルトである定着ベルト26に加圧ローラ27を押し当てて構成する。

【0079】上述した2次転写装置22には、画像転写後の転写材をこの定着装置25へと搬送する転写材搬送機構も備えてなる。もちろん、2次転写装置22として、非接触のチャージャージを配置してもよく、そのような場合は、この転写材搬送機構を併せて備えることは確しくなる。

【0080】なお、図示例では、このような2次転写装置22および定着装置25の下に、上述したタンデム作像装置20と平行に、転写材の両面に画像を形成すべく転写材を反転する転写材反転装置28を備える。

【0081】さて、いまこのカラー複写機を用いてコピーをとるときは、原稿自動搬送装置400の原稿台30上に原稿をセットする。または、原稿自動搬送装置400を開いてスキヤナ300のコンタクトガラス32上に原稿をセットし、原稿をセットし、原稿自動搬送装置400を閉じてそれで押さえる。

【0082】そして、不図示のスタートスイッチを押すと、原稿自動搬送装置400に原稿をセットしたとき、原稿を搬送してコンタクトガラス32上へと移動した後、コンタクトガラス32上に原稿をセットしたときは、直ちにスキヤナ300を駆動し、第1走行体33および第2走行体34を走行する。そして、第1走行体33で光源から光を発射するとともに原稿からの反射光3をさらに反射して第2走行体34に向け、第2走行体34のミラーで反射して給像レンズ35を通して群取りセンサ36に入れ、原稿内容を群取りする。

【0083】また、不図示のスタートスイッチを押すと、不図示の駆動モーターで支持ローラ14・15・16の1つを回転駆動して他の2つのローラを従動回転し、中間転写体10を回転駆動する。同時に、個々の単色作像手段18でその像担持体40を回転して各像担持体40上にそれぞれ、ブラック・イエロ・マゼンタ・シアン

間転写体の回転搬送方向に沿って、最下流の1次転写位置から2次転写位置までの距離を L_2 としたとき、
$$L_2/V_L > \rho \cdot v \cdot e \cdot e_0$$
 となる。ことを特徴とする。

【0068】請求項3に係る発明は、上述した第27の目的を達成すべく、請求項27に記載の画像形成装置において、中間転写体上のトナー画像を転写材に転写する位置を2次転写位置とし、かつその2次転写位置で転写後に中間転写体クリーニング装置で中間転写体上の残留トナーを除去する位置を中間転写体クリーニング位置とし、中間転写体の回転搬送方向に沿って、2次転写位置と、中間転写体クリーニング位置までの距離を L_3 としたとき、
$$L_3/V_L > \rho \cdot v \cdot e \cdot e_0$$
 となる。ことを特徴とする。

【0069】請求項3に係る発明は、上述した第27の目的を達成すべく、請求項27に記載の画像形成装置において、2次転写位置で転写後に中間転写体クリーニング装置で中間転写体上の残留トナーを除去する位置を中間転写体クリーニング位置とし、かつ像担持体上のトナー画像を中間転写体に転写する位置を1次転写位置とし、中間転写体の回転搬送方向に沿って、中間転写体クリーニング位置から最上流の1次転写位置までの距離を L_4 としたとき、
$$L_4/V_L > \rho \cdot v \cdot e \cdot e_0$$
 となる。ことを特徴とする。

【0070】請求項3に係る発明は、上述した第27の目的を達成すべく、請求項27に記載の画像形成装置において、2次転写位置で転写後に中間転写体クリーニング装置で中間転写体上の残留トナーを除去する位置を中間転写体クリーニング位置とし、かつ像担持体上のトナー画像を中間転写体に転写する位置を1次転写位置とし、中間転写体の回転搬送方向に沿って、中間転写体クリーニング位置から最上流の1次転写位置までの距離を L_4 としたとき、
$$L_4/V_L > \rho \cdot v \cdot e \cdot e_0$$
 となる。ことを特徴とする。

【0071】図中符号100は複写機本体、200はその載せる給紙テーブル、300は複写機本体100上に取り付けるスキヤナ、400はさらにその上に取付ける原稿自動搬送装置(ADF)である。

【0072】複写機本体100には、中央に、無端ベルト状の中間転写体10を設ける。中間転写体10は、図2に示すように、ベース層11を、例えばフッ素樹脂層や帆布などのものにびく材料でつくり、その上に弾性層12を設ける。弾性層12は、例えばフッ素ゴムやアクリロニトリル・ブタジエン共重合ゴムなどである。その弾性層12の表面は、例えばフッ素系樹脂をコーティングして平滑性のよいコート層13で被覆する。

【0073】そして、図1に示すとおり、図示例では3つの支持ローラ14・15・16に掛け回して図中時計回りに回転搬送可能とする。

【0074】この図示例では、3つのうちの第2の支持ローラ15の左に、画像転写後に中間転写体10上に残留する残留トナーを除去する中間転写体クリーニング装置17を設ける。

る。

【0060】請求項22に係る発明は、上述した第22の目的を達成すべく、請求項1または12に記載の画像形成装置において、中間転写体に弾性層を設ける、ことを特徴とする。

【0061】請求項23に係る発明は、上述した第23の目的を達成すべく、請求項1または12に記載の画像形成装置において、中間転写体の表面に、トナーの付着力を低減するトナー付着力低減層を均一に形成してなる。ことを特徴とする。

【0062】請求項24に係る発明は、上述した第24の目的を達成すべく、請求項23に記載の画像形成装置において、トナー付着力低減層を、ステアリン酸亜鉛を用いて形成してなる。ことを特徴とする。

【0063】請求項25に係る発明は、上述した第25の目的を達成すべく、請求項23に記載の画像形成装置において、トナー付着力低減層を、ふっ素樹脂を用いて形成してなる。ことを特徴とする。

【0064】請求項26に係る発明は、上述した第26の目的を達成すべく、請求項23に記載の画像形成装置において、中間転写体に、ブラシを用いて転写残像を剥離した粒子を付着し、その付着した粒子によりトナー付着力低減層を形成してなる。ことを特徴とする。

【0065】請求項27に係る発明は、上述した第27の目的を達成すべく、請求項1または12に記載の画像形成装置において、中間転写体の回転搬送方向に沿って、その中間転写体の表面に電荷を付与する位置から、その中間転写体上のトナーの移動を行う位置までの距離を L_0 とし、その中間転写体の表面移動速度、体積抵抗率、および比誘電率を、それぞれ V_L 、 $\rho \cdot v$ 、および $L_0/V_L > \rho \cdot v \cdot e \cdot e_0$ となる。ことを特徴とする。

【0066】請求項28に係る発明は、上述した第27の目的を達成すべく、請求項1に記載の画像形成装置において、像担持体上のトナー画像を中間転写体に転写する位置を1次転写位置とし、中間転写体の回転搬送方向に沿って、隣接する1次転写位置の中でもっとも近い1次転写位置間の距離を L_1 とし、その中間転写体の表面移動速度、体積抵抗率、および比誘電率を、それぞれ V_L 、 $\rho \cdot v$ 、および $L_1/V_L > \rho \cdot v \cdot e \cdot e_0$ となる。ことを特徴とする。

【0067】請求項29に係る発明は、上述した第27の目的を達成すべく、請求項27に記載の画像形成装置において、像担持体上のトナー画像を中間転写体に転写する位置を1次転写位置とし、かつ中間転写体上のトナー画像を転写する位置を2次転写位置とし、中

【0092】現像装置61は、一成分現像剤を使用してもよいが、図示例では、磁性キャリアと非磁性トナーとよりなる二成分現像剤を使用する。そして、二成分現像剤を攪拌しながら搬送して現像スリーブ65に付着する攪拌部66と、その現像スリーブ65に付着した二成分現像剤のうちのトナーを像担持体10に転写する現像部67とで構成し、その現像部67より攪拌部66を低い位置とする。

【0093】攪拌部66には、平行な2本のスクリュ68を設ける。2本のスクリュ68の間は、両端を除いて仕切り板69で仕切る(図6参照)。また、現像ケーシング70にトナー濃度センサ71を取り付ける。

【0094】一方、現像部67には、現像ケーシング70の開口を通して像担持体40と対向して現像スリーブ65を設けるとともに、その現像スリーブ65内にマグネット72を固定して設ける。また、その現像スリーブ65

8で攪拌しながら搬送循環し、現像スリーブ65に供給する。現像スリーブ65に供給された現像剤は、マグネット72により汲み上げ保持し、現像スリーブ65上に磁気ブラシを形成する。磁気ブラシは、現像スリーブ65の回転とともに、ドクタブレード73によって適正な量に切り取りする。切り捨てられた現像剤は、攪拌部66に戻される。

【0096】他方、現像スリーブ65上の現像剤のうちのトナーは、現像スリーブ65に印加する現像バイアス電圧により像担持体40に転移してその像担持体40上の静電潜像を可視化する。可視像化後、現像スリーブ65上に残った現像剤は、マグネット72の磁力がないところで現像スリーブ65から離れて攪拌部66に戻る。

【0104】その後、現像装置61によりトナーを付着してその静電潜像を可視像化し、その可視像を1次転写装置62で中間転写体10上に転写する。画像転写後の像担持体40の表面は、像担持体クリーニング装置63で残留トナーを除き去って清掃し、除電装置64で除電して再度の画像形成に備える。

【0105】図4は、図1に示すカラー複写機の要部断面図である。同図においては、タンデム作像装置20の各単色作像手段18、その単色作像手段18の各像担持体40、各現像装置61、各像担持体クリーニング装置63、および各単色作像手段18の像担持体40にそれぞれ対向して設ける各1次転写装置62の各符号の後に、それぞれブラケットの場合はBKを、イエロの場合はYを、マゼンタの場合はMを、シアンの場合はCを付し示す。

【0106】この図4から判るとおり、図示例のタンデム作像装置20では、中間転写体10の回転方向に沿って上流から下流へ、単色作像手段18をイエロ、シヤ

ン、マゼンタ、ブラックの順に配置する。このように、最下流位置に黒の単色作像手段18BKを配置すると、中間転写体10上のトナーが像担持体40C上に転移したとしても、黒色が目立たず、トナーをリサイクル使用することができる。

【0107】そして、この説明では、そのうち少なくとも2つの単色作像手段18にトナーリサイクル装置80を備えればよく、特に中間転写体10の回転搬送方向最上流位置に配置する単色作像手段18にトナーリサイクル装置80を備えればよく、また少なくともトナー劣化の少ない黒の単色作像手段18BKにはトナーリサイクル装置80を備えればよい。しかし、図示例では、すべての単色作像手段18にトナーリサイクル装置80を備えるようにしてなる。

【0108】図5および図6には、そのトナーリサイクル装置80を示す。図5に示すとおり、像担持体クリーニング装置63の回収スクリュ79には、一端は、ピン81を有するローラ部82を設ける。そして、そのローラ部82に、トナーリサイクル装置80のベルト状回収部材83の一端を掛け、その回収トナー搬送部材83の長手方向にピン81を入れる。回収トナー搬送部材83の他端は、回転軸86のローラ部87に掛け

る。

【0109】回収トナー搬送部材83は、回転軸86とともに、図6に示す搬送路ケーシング88内に入る。搬送路ケーシング88は、カーブ部89と一体につく

り、その現像装置61側の端部に、現像装置61の前述した2本のスクリュ68の1本を入れてなる。

【0110】そして、外部から駆動力を伝達して回収スクリュ79を回転するとともに、回収トナー搬送部材83を回転させ、像担持体クリーニング装置63で回収したトナーを搬送路ケーシング88内を通して現像装置61へと搬送し、スクリュ68の回転で現像装置61内に入る。その後、上述したとおり、2本のスクリュ68ですべてに現像装置61内にある現像剤とともに攪拌しながら搬送循環し、現像スリーブ65に供給してドクタブレード73により切り取りして後、像担持体40に転写してその像担持体40上の潜像を現像する。

【0111】図示例では、カラー画像を形成する画像形成装置において、像担持体40のまわりに現像装置61と像担持体クリーニング装置63とを備えて構成する単色作像手段18に、像担持体クリーニング装置63で回収したトナーを現像装置61へと搬送するトナーリサイクル装置80を備えるから、各色トナーのリサイクル使用を可能とすることができる。

【0112】また、単色作像手段18を中間転写体10に沿って複数並べてタンデム作像装置20を構成し、そのタンデム作像装置20で中間転写体10上に合成トナー画像を形成し、その合成トナー画像を転写して転写材

上に画像を形成するから、つまり中間転写体10を介して転写して転写材上に画像を形成するから、像担持体40に転写材が直接接触しないようにして、その転写材に付着する紙粉・屑等の異物がリサイクルトナーへ混入することを防ぎ、画像品質の低下を防止することができる。

【0113】加えて、転写部は、抵抗に大きく依存する。転写材は、一般に吸湿性が高く、湿度等の環境変化に対する抵抗変動が大きき。他方、中間転写体10は、主として樹脂材料等、転写材に対する抵抗の大きなものを用いることができ、環境変化に対する抵抗変動が小さい。そこで、上述した図示例のように、中間転写体10を介して間接転写して転写材上に画像を形成すると、転写材に直接転写する直接転写方式に比べて環境変化に対する抵抗変動を少なくして転写部を安定化することができる。

【0114】なお、上述した図示例では、個々の単色作像手段18で単色画像を形成し、それらの単色画像を合成して転写材に合成カラー画像を形成するカラー複写機に適用した場合について説明した。

【0115】しかし、この発明は、カラー画像形成装置に限らず、単色作像手段18を2つ並べて設け、それらの単色作像手段18で単色画像を形成し、それらの単色画像を中間転写材を介して転写して転写材に2色画像を形成する2色画像形成装置にも、個々の単色作像手段18に、像担持体クリーニング装置63で回収したトナーを現像装置61へと搬送するトナーリサイクル装置63を備えることにより、同様に適用して同様な効果を得ることができる。

【0116】トナーは、ポリエステル、ポリオール、ステレンアクリル等の樹脂に帯電制御剤(CCA)、色料を混合し、その固りにシリカ、酸化チタン等の物質を外添することによってその帯電特性、流動性を高めている。添加剤の粒径は、通常、0.1~1.5[μm]の範囲である。色料は、カーボンブラック、フタロシアニンブルー、キナクリドン、カーミン等を用いることができる。帯電特性は、図示例では負帯電である。

【0117】トナーは、ワックス等を分散混合させた母体トナーに上記各種の添加剤を外添しているものも使用することができる。ここまでの説明で、トナーは、粉砕法で作成されたものであるが、重合法等で作成したものも使用可能である。一般に重合法、加減法等で作成されたトナーは、形状係数を90%以上に形成することが可能で、さらに形状による添加剤の被覆率も極めて高くなる。

【0118】ここで、形状係数は、本来ならば球形と比べて、「粒子」と同体積の球の表面積/実粒子の表面積*100%で定義されるが、測定がかなり困難になるので、円形度で算出する。その定義は、「粒子」と同じ形で、円形度を持つ円の周長/実粒子の長方形周長*100%

【0092】現像装置61は、一成分現像剤を使用してもよいが、図示例では、磁性キャリアと非磁性トナーとよりなる二成分現像剤を使用する。そして、二成分現像剤を攪拌しながら搬送して現像スリーブ65に付着する攪拌部66と、その現像スリーブ65に付着した二成分現像剤のうちのトナーを像担持体10に転写する現像部67とで構成し、その現像部67より攪拌部66を低い位置とする。

【0093】攪拌部66には、平行な2本のスクリュ68を設ける。2本のスクリュ68の間は、両端を除いて仕切り板69で仕切る(図6参照)。また、現像ケーシング70にトナー濃度センサ71を取り付ける。

【0094】一方、現像部67には、現像ケーシング70の開口を通して像担持体40と対向して現像スリーブ65を設けるとともに、その現像スリーブ65内にマグネット72を固定して設ける。また、その現像スリーブ65

8で攪拌しながら搬送循環し、現像スリーブ65に供給する。現像スリーブ65に供給された現像剤は、マグネット72により汲み上げ保持し、現像スリーブ65上に磁気ブラシを形成する。磁気ブラシは、現像スリーブ65の回転とともに、ドクタブレード73によって適正な量に切り取りする。切り捨てられた現像剤は、攪拌部66に戻される。

【0096】他方、現像スリーブ65上の現像剤のうちのトナーは、現像スリーブ65に印加する現像バイアス電圧により像担持体40に転移してその像担持体40上の静電潜像を可視化する。可視像化後、現像スリーブ65上に残った現像剤は、マグネット72の磁力がないところで現像スリーブ65から離れて攪拌部66に戻る。

【0104】その後、現像装置61によりトナーを付着してその静電潜像を可視像化し、その可視像を1次転写装置62で中間転写体10上に転写する。画像転写後の像担持体40の表面は、像担持体クリーニング装置63で残留トナーを除き去って清掃し、除電装置64で除電して再度の画像形成に備える。

【0105】図4は、図1に示すカラー複写機の要部断面図である。同図においては、タンデム作像装置20の各単色作像手段18、その単色作像手段18の各像担持体40、各現像装置61、各像担持体クリーニング装置63、および各単色作像手段18の像担持体40にそれぞれ対向して設ける各1次転写装置62の各符号の後に、それぞれブラケットの場合はBKを、イエロの場合はYを、マゼンタの場合はMを、シアンの場合はCを付し示す。

【0106】この図4から判るとおり、図示例のタンデム作像装置20では、中間転写体10の回転方向に沿って上流から下流へ、単色作像手段18をイエロ、シヤ

ン、マゼンタ、ブラックの順に配置する。このように、最下流位置に黒の単色作像手段18BKを配置すると、中間転写体10上のトナーが像担持体40C上に転移したとしても、黒色が目立たず、トナーをリサイクル使用することができる。

【0107】そして、この説明では、そのうち少なくとも2つの単色作像手段18にトナーリサイクル装置80を備えればよく、特に中間転写体10の回転搬送方向最上流位置に配置する単色作像手段18にトナーリサイクル装置80を備えればよく、また少なくともトナー劣化の少ない黒の単色作像手段18BKにはトナーリサイクル装置80を備えればよい。しかし、図示例では、すべての単色作像手段18にトナーリサイクル装置80を備えるようにしてなる。

【0108】図5および図6には、そのトナーリサイクル装置80を示す。図5に示すとおり、像担持体クリーニング装置63の回収スクリュ79には、一端は、ピン81を有するローラ部82を設ける。そして、そのローラ部82に、トナーリサイクル装置80のベルト状回収部材83の一端を掛け、その回収トナー搬送部材83の長手方向にピン81を入れる。回収トナー搬送部材83の他端は、回転軸86のローラ部87に掛け

る。

【0109】回収トナー搬送部材83は、回転軸86とともに、図6に示す搬送路ケーシング88内に入る。搬送路ケーシング88は、カーブ部89と一体につく

り、その現像装置61側の端部に、現像装置61の前述した2本のスクリュ68の1本を入れてなる。

【0110】そして、外部から駆動力を伝達して回収スクリュ79を回転するとともに、回収トナー搬送部材83を回転させ、像担持体クリーニング装置63で回収したトナーを搬送路ケーシング88内を通して現像装置61へと搬送し、スクリュ68の回転で現像装置61内に入る。その後、上述したとおり、2本のスクリュ68ですべてに現像装置61内にある現像剤とともに攪拌しながら搬送循環し、現像スリーブ65に供給してドクタブレード73により切り取りして後、像担持体40に転写してその像担持体40上の潜像を現像する。

【0111】図示例では、カラー画像を形成する画像形成装置において、像担持体40のまわりに現像装置61と像担持体クリーニング装置63とを備えて構成する単色作像手段18に、像担持体クリーニング装置63で回収したトナーを現像装置61へと搬送するトナーリサイクル装置80を備えるから、各色トナーのリサイクル使用を可能とすることができる。

【0112】また、単色作像手段18を中間転写体10に沿って複数並べてタンデム作像装置20を構成し、そのタンデム作像装置20で中間転写体10上に合成トナー画像を形成し、その合成トナー画像を転写して転写材

上に画像を形成するから、つまり中間転写体10を介して転写して転写材上に画像を形成するから、像担持体40に転写材が直接接触しないようにして、その転写材に付着する紙粉・屑等の異物がリサイクルトナーへ混入することを防ぎ、画像品質の低下を防止することができる。

【0113】加えて、転写部は、抵抗に大きく依存する。転写材は、一般に吸湿性が高く、湿度等の環境変化に対する抵抗変動が大きき。他方、中間転写体10は、主として樹脂材料等、転写材に対する抵抗の大きなものを用いることができ、環境変化に対する抵抗変動が小さい。そこで、上述した図示例のように、中間転写体10を介して間接転写して転写材上に画像を形成すると、転写材に直接転写する直接転写方式に比べて環境変化に対する抵抗変動を少なくして転写部を安定化することができる。

【0114】なお、上述した図示例では、個々の単色作像手段18で単色画像を形成し、それらの単色画像を合成して転写材に合成カラー画像を形成するカラー複写機に適用した場合について説明した。

【0115】しかし、この発明は、カラー画像形成装置に限らず、単色作像手段18を2つ並べて設け、それらの単色作像手段18で単色画像を形成し、それらの単色画像を中間転写材を介して転写して転写材に2色画像を形成する2色画像形成装置にも、個々の単色作像手段18に、像担持体クリーニング装置63で回収したトナーを現像装置61へと搬送するトナーリサイクル装置63を備えることにより、同様に適用して同様な効果を得ることができる。

【0116】トナーは、ポリエステル、ポリオール、ステレンアクリル等の樹脂に帯電制御剤(CCA)、色料を混合し、その固りにシリカ、酸化チタン等の物質を外添することによってその帯電特性、流動性を高めている。添加剤の粒径は、通常、0.1~1.5[μm]の範囲である。色料は、カーボンブラック、フタロシアニンブルー、キナクリドン、カーミン等を用いることができる。帯電特性は、図示例では負帯電である。

【0117】トナーは、ワックス等を分散混合させた母体トナーに上記各種の添加剤を外添しているものも使用することができる。ここまでの説明で、トナーは、粉砕法で作成されたものであるが、重合法等で作成したものも使用可能である。一般に重合法、加減法等で作成されたトナーは、形状係数を90%以上に形成することが可能で、さらに形状による添加剤の被覆率も極めて高くなる。

【0118】ここで、形状係数は、本来ならば球形と比べて、「粒子」と同体積の球の表面積/実粒子の表面積*100%で定義されるが、測定がかなり困難になるので、円形度で算出する。その定義は、「粒子」と同じ形で、円形度を持つ円の周長/実粒子の長方形周長*100%

【0119】また、単色作像手段18を中間転写体10に沿って複数並べてタンデム作像装置20を構成し、そのタンデム作像装置20で中間転写体10上に合成トナー画像を形成し、その合成トナー画像を転写して転写材

上に画像を形成するから、つまり中間転写体10を介して転写して転写材上に画像を形成するから、像担持体40に転写材が直接接触しないようにして、その転写材に付着する紙粉・屑等の異物がリサイクルトナーへ混入することを防ぎ、画像品質の低下を防止することができる。

【0120】そして、この説明では、そのうち少なくとも2つの単色作像手段18にトナーリサイクル装置80を備えればよく、特に中間転写体10の回転搬送方向最上流位置に配置する単色作像手段18にトナーリサイクル装置80を備えればよく、また少なくともトナー劣化の少ない黒の単色作像手段18BKにはトナーリサイクル装置80を備えればよい。しかし、図示例では、すべての単色作像手段18にトナーリサイクル装置80を備えるようにしてなる。

【0121】図5および図6には、そのトナーリサイクル装置80を示す。図5に示すとおり、像担持体クリーニング装置63の回収スクリュ79には、一端は、ピン81を有するローラ部82を設ける。そして、そのローラ部82に、トナーリサイクル装置80のベルト状回収部材83の一端を掛け、その回収トナー搬送部材83の長手方向にピン81を入れる。回収トナー搬送部材83の他端は、回転軸86のローラ部87に掛け

る。

【0122】回収トナー搬送部材83は、回転軸86とともに、図6に示す搬送路ケーシング88内に入る。搬送路ケーシング88は、カーブ部89と一体につく

り、その現像装置61側の端部に、現像装置61の前述した2本のスクリュ68の1本を入れてなる。

【0123】そして、外部から駆動力を伝達して回収スクリュ79を回転するとともに、回収トナー搬送部材83を回転させ、像担持体クリーニング装置63で回収したトナーを搬送路ケーシング88内を通して現像装置61へと搬送し、スクリュ68の回転で現像装置61内に入る。その後、上述したとおり、2本のスクリュ68ですべてに現像装置61内にある現像剤とともに攪拌しながら搬送循環し、現像スリーブ65に供給してドクタブレード73により切り取りして後、像担持体40に転写してその像担持体40上の潜像を現像する。

【0124】図示例では、カラー画像を形成する画像形成装置において、像担持体40のまわりに現像装置61と像担持体クリーニング装置63とを備えて構成する単色作像手段18に、像担持体クリーニング装置63で回収したトナーを現像装置61へと搬送するトナーリサイクル装置80を備えるから、各色トナーのリサイクル使用を可能とすることができる。

【0125】また、単色作像手段18を中間転写体10に沿って複数並べてタンデム作像装置20を構成し、そのタンデム作像装置20で中間転写体10上に合成トナー画像を形成し、その合成トナー画像を転写して転写材

ころ、図10示すように帯電量分布がシャープになっている。そして、その半値幅は、 $1.1[fC/1.0\mu m]$ であった。

[0144] シャープさに関する指標は、一般には半値幅で表され、その値が小さい方がシャープである。一般に、分布がシャープであるとき近しい値の q/d を有するトナーが多く存在することとなり、現像液に対して分布があることから均一な現像が達成できる。反対に、分布がブロードとなると存在するトナー帯電量の範囲が広がり、現像能力の範囲も広がることから、現像量の変動が生じやすくなる。

[0145] 次に、リサイクル後の同様の半値幅を求めると、 $1.7[fC/1.0\mu m]$ であった。さらに、一般の粉砕トナーを使用したシステムでリサイクル後の値を測定してみると、 $2.7[fC/1.0\mu m]$ であった。これは、クリーニング時にトナーがクリーニング部材であるブレードと、像担体40に挟まれることで、その押圧力によりトナーが粉砕され易くなる。そうすると、平均粒径に対して小粒径のトナーの存在比が増加すると、さらに小粒径トナーが別のトナーに付着して2次粒子的な分布、大粒径トナーとして存在することから、 q/d が広がってプロード化する。

[0146] 図11には、上記半値幅と地汚れ率の関係を示したが、2.2を超える地汚れ率の境界値0.08(Δ1Dとして未現像トナーに対する反付録率)の差(Δ1D)を超えてしまっている。これより、従来の粉砕トナーでは、リサイクル後の地汚れ率が低下している。ところが、半値幅が2.2以下であるトナーを使用すると、リサイクルを実施しても十分な帯電量を維持して画像品質が劣化しない。

[0147] 次に、中間転写体10の弾性化について、以下説明する。

[0148] 中間転写体10の硬度HSの範囲を、好ましくは $10\leq HS\leq 60'$ (JIS-A)とする。ベルト部でスリッパする可能性がある。それに対して、図10のローラを使用すると、回転すなわち走行に対するローラは極めて減少させることができる。ところが、硬度が高ざると、精度による余給度が狭まり、像担体40にうまく密着しない可能性も出てくる。そこで、中間転写体10に弾性層12を設けることで硬度を低くし、可塑性を持たせて像担体40との密着余給度を向上させ、転写率を向上させて、リサイクルトナー量を減らすことで画像劣化を回避し画像品質を維持しようとしたものである。

[0149] 硬度 $10'$ (JIS-A)より下のものは、寸法精度良く成形することが非常に困難である。これは、成型時に収縮・膨張を受け易いことに起因する。また、来からくする場合には基材へオイル成分を含有させることが一般的であるが、加圧状態で連続動作時させ

成したもので、図示省略するが、基端をカルダ等で支持し、例えばそのホルダ等をばね付勢して先端を中間転写体10に押し当ててなる。

[0155] そして、中間転写体10の回転とともに、転写体96で転写し、その付着した転写体97よりなる中間転写体10の表面に、その付着した転写体97よりなるトナー付着力低減層98を形成する。トナー付着力低減層98は、均一な、縞状もしくは一層状の層を形成する。なお、図14中符号99は、中間転写体10上付着したトナーを示す。

[0157] 転写体97は、 $0.1\sim 1.0\mu m$ がよい。粒子径が大きくなると、トナー付着力低減層98を均一に形成しても凹凸ができてトナーがトラップされる可能性が生じる。

[0158] 転写体96の押し当て力は、 $1\sim 20g/cm$ の範囲で通過で、 $20g/cm$ を超えると、図15に示すように通刺に付着し、トナー付着力低減層98が2～3層になって、トナー99が転写された後、中間転写体10の表面に保持されないか、中間転写体10に付着して搬送している途中で転移してしまうおそれがある。また、 $1g/cm$ を下回ると転写体96と中間転写体10の接触が不均一になり、トナー付着力低減層98が形成されない部分が生じて、結果的に中間転写体10表面へのトナーの固着が促進されることとなる。

[0159] ここで、図示例では、転写体96を中間転写体10に直接押し当て、転写体96の粒子97を中間転写体10に付着した。しかし、図示省略するが、ブラシを用いて転写体96から削り落とした転写体96を中間転写体10に付着するようにしてもよい。

[0160] この場合、転写体96および中間転写体10に対するブラシの喰い込み量は、それぞれ $0.5mm\sim 2mm$ が最適で、 $2mm$ を超えるとブラシによる当接圧が顕著になり、 $0.5mm$ を下回ると当接圧の低下による転写体96からの焼き取り、および中間転写体10表面への付着を十分行うことができなくなる。

[0161] ここで、転写体97として、ステアリン酸亜鉛を用いた場合について説明する。ステアリン酸亜鉛は、トナーとの分散性がよいが、トナーと逆の帯電特性を有しているトナーとの付着力も高い。これに類する材料として、ワックス材料を上げることができる。それは、カルナバワックス、ポリプロピレン等の有機材料によるものである。

[0162] つまり、ステアリン酸亜鉛を使用することにより、トナー99との付着力を高め中間転写体10上でのトナー99の保持を確保するという一方、転写体97が中間転写体10上に最も密着されていることから、トナー99が中間転写体10に直接付着する可能性を著しく低減する。さらに、ステアリン酸亜鉛の帯電特性は、トナーとは逆であるから、トナー99を付着しやすくする

と同時に、ステアリン酸亜鉛と中間転写体10の付着力は低減するので、中間転写体10上の残トナーはクリーニング装置17で十分焼き取りことができる。

[0163] 次に、転写体97として、ふっ素樹脂を含有するものを用いた場合について説明する。

[0164] ふっ素樹脂は、トナー99、中間転写体10、像担体40の表面材料に対して親和性を有する。これは、ふっ素自体の表面エネルギーが他の材料に対して低いことが理由として上げられる。また、ふっ素樹脂は、中間転写体10とも親和性が高いために、表面への

トナー、部材の付着を回避することができ、

[0165] 主たる材料として、ポリテトラフルオロエチレン(PTFE)、テトラフルオロエチレン-パーフルオロアルキルニールエーテル(PFA)、テトラフルオロエチレン-ヘキサフルオロプロピレン重合体(FEP)、ポリクロロトリフルオロエチレン(PCTFE)、テトラフルオロエチレン-エチレン重合体(ETFE)、クロロトリフルオロエチレン-エチレン重合体(ECTFE)、ポリビニリデンフルオライド(PVDF)、ポリビニルフルオライド(PVF)等を上げることができる。これらの材料の組合せもしくは導電性材料等の含有は、中間転写体10の体積および表面抵抗の特性に大きく関係するので適宜調整するのがよい。

[0166] ふっ素樹脂材料の採用により、トナー99と基本的に逆極性に帯電してトナー99との静電的付着力を低減し、中間転写体10上に存在する転写体トナーをクリーニング装置17で焼き取ることを可能として、次の画像での裏面の帯電を防止することができる。

[0167] さて、上述した転写体96の押し当て強さは、加減可能とすることもできる。

[0168] 例えば図16に示すように、中間転写体10に向けて、発光素子110と受光素子111とを備え、フォトセンサ等の発光素子110から発した光を、トナー領域パターンを形成した中間転写体10表面で反射して受光素子111に入射し、強度を後述して、それに基き中間転写体10に対する転写体96の押し当て強さを変更するようにする。

[0169] 後述タイミングは、例えばA4サイズのシートは長さ $29.7cm$ に対して $5\sim 10$ 回とし、最小間隔約 $3cm$ とする。図17にそれにより後述された、画像パターンによる検出力電圧を示す。ハーフトーン画像では出力が高、ベタ画像では出力が低くなっている。

[0170] ハーフトーン画像では、ベタ画像と比較して残トナーの面積が低いために、クリーニングブレード93による当接よりトナー付着力低減層98が焼き取られやすく、部分的には剥離してしまいう可能性もある。

[0171] そこで、当初より検算してきた検分値をその値に設定しておいて、その値に達したときに転写体

り、何らかの方策を講じなければ良好な画像が得られない結果となった。

【0185】

【発明の効果】以上説明したとおり、請求項1に係る発明によれば、合成トナー画像を形成する画像形成装置において、像担持体のまわりに現像装置と像担持体クリーニング装置とを備えて構成する単色作像手段に、像担持体クリーニング装置で回収したトナーを現像装置へと搬送するトナーリサイクル装置を備えるから、個別トナーのリサイクル使用を可能とすることができ、

【0186】また、単色作像手段を中間転写体に沿って複数並べてタンデム作像装置を構成し、そのタンデム作像装置で中間転写体上に合成トナー画像を形成し、その合成トナー画像を転写して転写材上に画像を形成するから、つまり中間転写体を介して転写して転写材上に画像を形成するから、像担持体に転写材が直接接触しないようにして、その転写材に付着する紙粉・屑等の異物の低下サイクルトナーへ搬入することを防ぎ、画像品質の低下を防止することができ、

【0187】加えて、転写率は、抵抗に大きく依存する。転写材は、一般に吸湿性が高く、湿度等の環境変化に対する抵抗変動が大きいが、他方、中間転写材は、主として樹脂材料で、転写材より抵抗の大きなものを用いることが多く、環境変化に対する抵抗変動が小さい。そこで、請求項1に係る発明のように、中間転写材を介して間接転写して転写材上に画像を形成すると、転写材の直接転写する直接転写方式に比べて環境変化に対する抵抗変動を少なくして転写率を安定化することができる。

【0188】そして、請求項1に係る発明によれば、タンデム作像装置を設け、中間転写材を備え、トナーリサイクル装置を有することで、それらの組み合わせによりさらに以下の効果を達成し得るものであります。

【0189】1) タンデム作像装置を設け、像担持体上に形成したトナー画像を直接転写して転写材上に画像を形成するものでは、転写電圧のステップアップによる転写率の問題がある。しかし、中間転写材を用いた中間転写方式を採用することにより転写電圧を低減して転写率の発生を防止することができる。

【0190】2) 中間転写方式を採用すると、スピードがダウンするが、タンデム作像装置を設けたタンデム方式を採用することにより、特に多色画像形成装置でスピードをアップして生産性を向上させることができる。

【0191】3) 中間転写方式を採用することで転写率を向上して、特に多色画像形成装置では、リサイクルトナー量を低減することができる。

【0192】4) 多色画像形成装置でトナーリサイクル方式を採用すると、特に黒トナーを低減して社会環境の維持に貢献することができる。

【0193】請求項2に係る発明によれば、カラー画像形成装置において、そのような効果を達成することができ

た転写位置から2次転写位置までの距離を設定すれば、中間転写体表面の帯電による転写時のトナー像の乱れを防止することができる。同様に、請求項30に記載のとおり、2次転写位置から中間転写体のクリーニング位置までの距離を設定すれば、中間転写体表面の帯電による転写時のトナー像の乱れを防止することができる。同様に、請求項31によっても中間転写体のクリーニング位置から帯び、中間転写体上で色重ねを行うために、第一色目の1次転写位置までの距離を設定すれば、ベルト表面の帯電による転写時のトナー像の乱れを防止することができ、

【0181】ここで、図4の実施形態に基づいて、中間転写体1に求められる特性を試算する。図4においては4本の像担持体が中間転写体に接しているが、この場合の4本の像担持体間の距離はすべて等しく、 $L_1 = 120 \text{ mm}$ である。また、最終の像担持体と中間転写体の接触部から2次転写位置までの距離は $L_2 = 190 \text{ mm}$ であり、2次転写位置からクリーニング部までの距離は、 $L_3 = 245 \text{ mm}$ 、クリーニング部から最初の像担持体との接触部までは $L_4 = 95 \text{ mm}$ である。

【0182】上記の条件の内、請求項27に記載のようににLがもっとも短いのは、クリーニング部から最初の像担持体までの距離 L_4 であり、

$$(式11) \quad L_4 / V_L > \rho \cdot V \cdot \epsilon \cdot \epsilon_0$$

を満足すれば良好な画像が得られるはずである。

【0183】図4について、中間転写体としては、比誘電率 $\epsilon = 8$ 、厚さ $d = 150 \mu\text{m}$ 、周長 $S = 1060 \text{ mm}$ のフッ素樹脂シートからなるシームレスベルトを用いた。この中間転写体を抵抗値の異なるものを用意し、中間転写体の体積抵抗率 ρ および表面抵抗率 ρ_s を三菱化学製測定器（商品名：ハイレスタ、プローブ：HR S）で測定したところ、一方の中間転写体Aは体積抵抗率 $\rho = 1 \times 10^{11} \Omega \cdot \text{cm}$ 、および表面抵抗率 $\rho_s = 1 \times 10^9 \sim 1 \times 10^{10} \Omega / \square$ （印加電圧：500V、タイマー：10秒）であった。また、他方の中間転写体Bは体積抵抗率 $\rho = 5 \times 10^{12} \sim 1 \times 10^{13} \Omega \cdot \text{cm}$ 、および表面抵抗率 $\rho_s = 5 \times 10^{10} \sim 1 \times 10^{11} \Omega / \square$ （印加電圧：500V、タイマー：10秒）であった。機械の動作速度は中間転写体の線速度 $V_L = 360 \text{ mm/sec}$ となる様に、画像を印刷してみたところ、中間転写体Aでは比較的良好な画像であったが、中間転写体Bでは1次転写が良く、特に色を重ねていくにつれて転写率が低下した。また、全体的に細かい斑点模様が見られた。

【0184】ここで、本実施条件での $L_4 / V_L = 0.26$ であり、中間転写体Aでは $\rho \cdot V \cdot \epsilon \cdot \epsilon_0 = 0.71 \sim 0.354$ 、中間転写体Bでは $\rho \cdot V \cdot \epsilon \cdot \epsilon_0 = 3.54 \sim 7.1$ である。よって、中間転写体Aでは概略本発明で規定された条件内であったのに対して、中間転写体Bは本発明の記載の条件下から大きく逸脱してお

時定数 τ に相当し、 $\tau = RC$ となる。単位面積当たりのCおよびRは、中間転写体の厚さを d 、体積抵抗率を ρ 、比誘電率を ϵ 、真空の誘電率を ϵ_0 としたとき、

$$(式7) \quad C = \epsilon \cdot \epsilon_0 / d$$

$$(式8) \quad R = \rho \cdot V \cdot d \text{ となることから、時定数 } \tau =$$

$$(式9) \quad \tau = \rho \cdot V \cdot \epsilon \cdot \epsilon_0$$

となる。したがって、中間転写体厚み方向の時定数は、 $\tau = (\text{中間転写体の体積抵抗率}) \times (\text{中間転写体の体積抵抗率})$ で表されることがわかる。

【0178】ここで、中間転写体が何らかの影響で表面が帯電したとする。中間転写体が帯電する要因としては、機械を構成する何らかの部品との摩擦帯電や、コロナチャージや放電プラズマなどによる放電による帯電またはローラや板など、導電性の部材との接触による帯電などが挙げられる。例えば、2次転写前にトナーを帯電してトナーの Q/M を挙げて転写効率を向上する場合や、中間転写体クリーニング前に2次転写機トナーをコロナチャージや通電ローラで帯電させ極性を揃えてクリーニングし易くしたりする場合はこの例に当てはまっている。そのほか、中間転写体が導電性のローラに接き付いているだけでも、摩擦帯電を起こして表面に電荷の蓄積現象なども観測され、この電荷が転写不良などを引き起こしている場合がある。

【0179】このように、中間転写体の表面の帯電は、トナー像の移動に際し大きな問題となる。トナーは電界の作用で移動するが、その電界強度を決定するのは、中間転写体表面と対向面、例えば像担持体の葉管や2次転写ローラの芯金、との電位差であるが、中間転写体表面が帯電していると、その影響は大きい。また、中間転写体表面が全面に渡って均一に帯電しているならばまだしも、実際には、中間転写体表面は帯電ムラが生じていることが多く、その場合は、部分部分で転写ムラとなってしまう。よって、中間転写体表面が帯電してから、次にトナーの移動の行程に入るまでの間を T_0 とすると、 $T_0 < \tau$ であれば中間転写体上面電位が十分に減衰し、トナーの移動に与える影響が少ない。中間転写体何らかの影響で表面が帯電してから次のトナーの移動に入るまでの、中間転写体上の表面の長さ L_0 、中間転写体表面の移動速度を V_L としたとき、 T_0 は L_0 / V_L と表

されるので、

$$(式10) \quad L_0 / V_L < \rho \cdot V \cdot \epsilon \cdot \epsilon_0 \text{ となる。}$$

【0180】ここで、この発明の請求項27に記載のとおり、式10を満たすように中間転写体の体積抵抗率、比誘電率、移動速度、および距離を設定すれば、中間転写体表面の帯電による転写時のトナー像の乱れを防止することができる。以下、同様に、請求項28に記載のとおり、1次転写を繰り返す場合のタンデム中間転写体方式での像担持体間距離を設定すれば、中間転写体表面の帯電による転写時のトナー像の乱れを防止することができ、同様に、請求項29に記載のとおり、最終の1

体96の押し当て力を 10 g/cm から 15 g/cm へ約10枚画像成分98の形成を促進させる。押し当てトナー付着力低減層98の形成を促進させる。押し当て力および押し当て時間は、先に述べたプロセス最適化により、大きく依存するものでシステムにより最適化する。【0172】ところで、非画像形成時に中間転写体10を回転し、クリーニング装置17のクリーニング付着力低減層98が剥離する。それは、トナー付着力低減層98が単独に付着しているだけであるからで、それ以上行うと、クリーニングプレート93との相互作用で中間転写体10表面が傷つき凹凸形状になる。

【0173】非画像形成時に中間転写体10を回転し、クリーニング装置17のクリーニングプレート93を中間転写体10に当接すると、約1分でトナー付着力低減層98が剥離する。それは、トナー付着力低減層98が単独に付着しているだけであるからで、それ以上行うと、クリーニングプレート93との相互作用で中間転写体10表面が傷つき凹凸形状になる。

【0174】その後、粒子結着層96を約2分間、押し当てると、均一なトナー付着力低減層98を形成することができ、これまでの場合はトナーがトナー付着力低減層98の間に入り込む場合もあったが、このようにすると、完全にトナーを中間転写体10表面から除去することが可能となる。これにより、常に転写機トナーのクリーニングが確実に行われ、残像、固着等の発生を防止することができる。

【0175】さて、通常、抵抗体における時定数 τ は、 $\tau = (\text{抵抗体の誘電率}) \times (\text{抵抗体の体積抵抗率})$ で表されることが知られている。これは抵抗体の抵抗成分と容量成分とが並列に接続された回路の場合の時定数であり、中間転写体時定数は上記の回路を等価回路と見なすことができる。

【0176】図19のモデルにおいて、中間転写体のベルト表面に蓄積した電荷を q 、そのときの中間転写体表面間の電位差を V とし、中間転写体の静電容量を C と抵抗 R に流れる変位電流を I とすると、

$$(式1) \quad q = C \cdot V$$

$$(式2) \quad I = V / R$$

$$(式3) \quad I = dq / dt$$

上記の数式を整理すると、

$$(式4) \quad (1/q) \times dq / dt = 1 / (RC)$$

となり、この数式を q について時間で解くと、

$$(式5) \quad q(t) = \exp(-t/RC)$$

上記の関係より、表面電位に換算すると、

$$(式6) \quad V(t) = \exp(-t/RC) / C$$

となり、 $t = RC$ のときに中間転写体が帯電した直後の初期の電位差 $1/e$ になる。【0177】 V が $1/e$ に減衰するまでの時間、すなわち、中間転写体上面電位が下降して、下面電位との電位差が初期状態の $1/e$ になるまでの時間が中間転写体の

形成装置において、像担持体上のトナー画像をいったん中間転写体上に転写した後、その中間転写体上のトナー画像を転写材に転写する構成とし、トナーリサイクル装置を単色作像手段に備え、像担持体クリーニング装置で回収したトナーを現象装置へと搬送するから、上記請求項12に係る発明と同様の効果を達成することができる。

【0211】請求項18に係る発明によれば、画像形成装置において、現象時に、現象装置に現象バイアス電圧を印加して交互電界を形成するから、上記請求項1または12に係る発明の効果を達成することができる。現象装置は12に係る発明の効果に加えて、直流電圧に交流電圧を重ねた振動バイアス電圧を印加し、未帯電や低帯電の不純物が像担持体に付着することを防いで一層の画像品質の低下を防止することができる。

【0212】請求項19に係る発明によれば、画像形成装置において、溶剤剤を含有するトナーを使用するから、上記請求項1または12に係る発明の効果に加え、溶剤剤によるトナーの粉砕を防いで一層の画像品質の低下を防止することができる。

【0213】請求項20に係る発明によれば、画像形成装置において、円形度190以上のトナーを使用するから、上記請求項1または12に係る発明の効果に加え、トナーの表面形状を滑らかとしてトナーの転写率を向上し、リサイクルトナー量を低減して画質の劣化を防止し、一層の画像品質の低下を防止することができる。

【0214】請求項21に係る発明によれば、画像形成装置において、(トナーの帯電量)/(トナー粒径)の分布曲線において半値幅が $2.2(fC/10\mu m)$ 以下であるトナーを使用するから、上記請求項1または12に係る発明の効果に加えて、分布曲線をシャープに維持し、トナーリサイクル時におけるトナーの成分比の変動をなくして画質の劣化を防止し、一層画像品質の低下を防止することができる。

【0215】請求項22に係る発明によれば、画像形成装置において、中間転写体に弾性層を設けるから、上記請求項1または12に係る発明の効果に加えて、像担持体に中間転写体を密着してトナーの転写率を向上し、一層の画像品質の低下を防止することができる。

【0216】請求項23に係る発明によれば、中間転写体において、表面にトナーの付着力を低減するトナー付着力低減層を均一に形成するから、トナーが直接付着せず、クリーニング性能を向上して、中間転写体表面の劣化を招くことなく、残像やトナー固着の発生を防止しながら、上記請求項1または12に係る発明の効果を達成することができる。

【0217】請求項24に係る発明によれば、トナー付着力低減層を、ステアリン酸亜鉛を用いて形成するから、逆溶剤に希薄するステアリン酸亜鉛によりトナーと付着しやすくとともに、トナーが直接中間転写体表面に付着しないようにし、中間転写体に対するトナー付

一画像を形成し、その合成トナー画像を転写して転写材上に画像を形成する構成とし、トナーリサイクル装置を単色作像手段に備え、像担持体クリーニング装置で回収したトナーを現象装置へと搬送するから、上記請求項1に係る発明と同様の効果を達成することができる。

【0203】請求項12に係る発明によれば、単色画像形成装置において、像担持体のまわりに現象装置と像担持体クリーニング装置とを備えて構成する単色作像手段に、像担持体クリーニング装置で回収したトナーを現象装置へと搬送するトナーリサイクル装置を備えるから、トナーのリサイクル使用を可能とすることができる。

【0204】また、像担持体上のトナー画像をいったん中間転写体上に転写した後、その中間転写体上のトナー画像を転写材に転写するから、つまり中間転写体を介して転写して転写材上に画像を形成するから、像担持体に転写する紙粉・屑等の異物がリサイクルトナーへ混入することを防止し、画質の低下を防止することができる。

【0205】加えて、転写率は、抵抗に大きく依存する。転写材は、一般に吸湿性が高く、湿度等の環境変化に対する抵抗変動が大きい。他方、中間転写体は、主に転写に用いる材料等、転写材より抵抗の大きなものを用いることが多く、環境変化に対する抵抗変動が小さい。そこで、請求項10に係る発明のように、中間転写体を介して間接転写して転写材上に画像を形成すると、転写材に直接転写する直接転写方式に比べて環境変化に対する抵抗変動を少なくして転写率を安定化することができる。

【0206】請求項13に係る発明によれば、像担持体がドラムであり、中間転写体がベルトまたはドラムであるタイプの画像形成装置において、そのような請求項12に係る発明の効果を達成することができる。

【0207】請求項14に係る発明によれば、像担持体がベルトであり、中間転写体がベルトまたはドラムであるタイプの画像形成装置において、上記請求項12に係る発明の効果を達成することができる。

【0208】請求項15に係る発明によれば、単色画像形成装置において、少なくとも像担持体を設け、画像形成装置本体に対して一括して搬送するプロセスカートリッジを構成するから、メンテナンス性を向上しながら、上記請求項12に係る発明の効果を達成することができる。

【0209】請求項16に係る発明によれば、単色画像形成装置の単色作像手段において、像担持体上のトナー画像を中間転写体を介して転写材に転写する一方、像担持体クリーニング装置で回収したトナーを現象装置へと搬送するトナーリサイクル装置を備えるから、上記請求項12に係る発明と同様の効果を達成することができる。

【0210】請求項17に係る発明によれば、単色画像

【0194】請求項3に係る発明によれば、カラー画像形成装置のタンデム作像装置において、中間転写体の回転搬送方向最上流位置に配置する単色作像手段はトナーリサイクル装置を備えることとし、'混色のおおそれなく、トナーをリサイクル使用しながら、上記請求項1に係る発明の効果を達成することができる。

【0195】請求項4に係る発明によれば、複数の単色作像手段のうち、少なくとも黒の単色作像手段は、トナーリサイクル装置を備えるから、リサイクルトナーへの異物の混入を防いで画像品質の低下を防止しながら、画像劣化の少ない黒のリサイクル使用を可能としながら、上記請求項1に係る発明の効果を達成することができる。

【0196】請求項5に係る発明によれば、カラー画像形成装置のタンデム作像装置において、中間転写体の回転搬送方向最下流位置に黒の単色作像手段を配置しながら、混色していても限りトナー劣化がないようにしながら、上記請求項1に係る発明の効果を達成することができる。

【0197】請求項6に係る発明によれば、2色画像形成装置において、上記請求項1に係る発明の効果を達成することができる。

【0198】請求項7に係る発明によれば、像担持体がドラムであり、中間転写体がベルトであるタイプの画像形成装置において、上記請求項1に係る発明の効果を達成することができる。

【0199】請求項8に係る発明によれば、像担持体および中間転写体とともにベルトであるタイプの画像形成装置において、上記請求項1に係る発明の効果を達成することができる。

【0200】請求項9に係る発明によれば、合成トナー画像を形成する画像形成装置において、少なくとも像担持体を設け、画像形成装置本体に対して一括して搬送するプロセスカートリッジを構成するから、メンテナンス性を向上しながら、上記請求項1に係る発明の効果を達成することができる。

【0201】請求項10に係る発明によれば、合成トナー画像を形成する画像形成装置の単色作像手段において、像担持体クリーニング装置で回収したトナーを現象装置へと搬送するトナーリサイクル装置を備え、中間転写体に沿って搬送されてタンデム作像装置を構成し、そのタンデム作像装置で中間転写体上に合成トナー画像を形成し、その合成トナー画像を転写して転写材上に画像を形成するから、上記請求項1に係る発明と同様の効果を達成することができる。

【0202】請求項11に係る発明によれば、合成トナー画像を形成する画像形成装置において、単色作像手段を中間転写体に沿って複数並べてタンデム作像装置を構成し、そのタンデム作像装置で中間転写体上に合成トナ

【0193】請求項2に係る発明によれば、トナー付着力低減層を、ふっ素樹脂を用いて形成するから、中間転写体表面とトナーとの間の物理性を高めるクリーニング性能を向上することにより、残像やトナー固着の発生を防止しながら、上記請求項1または12に係る発明の効果を達成することができる。

【0218】請求項25に係る発明によれば、トナー付着力低減層を、ふっ素樹脂を用いて形成するから、中間転写体表面とトナーとの間の物理性を高めるクリーニング性能を向上することにより、残像やトナー固着の発生を防止しながら、上記請求項1または12に係る発明の効果を達成することができる。

【0219】請求項26に係る発明によれば、中間転写体上に、ブラシを用いて粒子結着体から削り落とした粒子を付着し、その付着した粒子によりトナー付着力低減層を形成するから、クリーニング性能の向上を容易とし、中間転写体表面の劣化を招くことなく、残像やトナー固着の発生を簡単に防止しながら、上記請求項1または12に係る発明の効果を達成することができる。

【0220】請求項27に係る発明によれば、上記請求項1または12に係る発明の効果に加えて、何らかの影響によって中間転写体の表面が帯電するような場合には、その後1次転写や、2次転写、中間転写体上トナーのクリーニングなどの、中間転写体上のトナーが移動するプロセス管理に到達するまでに中間転写体上の電荷が緩和され、トナーの移動を妨げることがなく、特別の装置を必要とすることなく良好な画像を提供できる。

【0221】請求項28に係る発明によれば、上記請求項1または12に係る発明の効果に加えて、中間転写体が1次転写位置から次の1次転写位置へと移動する間に、中間転写体表面に移動した電荷が、1/e以下に減衰することによって、中間転写体上の電位履歴が十分に解消され、中間転写体上でトナー像を重ねて転写する場合には、画像が乱れたり、転写効率が低下したりするようにならず、特別の装置を必要とすることなく良好な画像を提供できる。

【0222】請求項29に係る発明によれば、上記請求項1または12に係る発明の効果に加えて、中間転写体が、色を重ねを行う最終の1次転写位置から2次転写位置まで移動する間に、中間転写体表面に移動した電荷が、1/e以下に減衰する。よって、中間転写体上の電位履歴が十分に解消され、中間転写体上から転写材にトナー像を転写する場合、画像が乱れたり、転写効率が低下したりするようにならず、特別の装置を必要としない。

【0223】請求項30に係る発明によれば、上記請求項1または12に係る発明の効果に加えて、中間転写体が2次転写位置から中間転写体クリーニング位置まで移動する間に、中間転写体表面に生じた電荷が、1/e以下に減衰することによって、中間転写体上の電位履歴が十分に解消され、中間転写体上に転写材へのトナー像を写す際に残った異物トナーの電荷が十分に低下し、中

転写体クリーニングの効率が低下したりすることがない。

【0224】請求項31に係る発明によれば、上記請求項1または12に係る発明の効果に加えて、中間転写体が中間転写体クリーニング位置から1次転写位置へと移動する間に、中間転写体表面に移動した電荷が、1/e以下に減衰する。よって、中間転写体上の電位レベルに解消され、像担持体上から、中間転写体上へトナー像を転写する際に、トナー像の転移を電界が乱すようなことがない。

【面の簡単な説明】

【図1】この発明の一実施の形態を示すもので、カラー複写機における全体概略構成図である。
 【図2】そのカラー複写機で用いる中間転写体の断面構成の部分拡大断面図である。
 【図3】そのカラー複写機で用いるダンデム作像装置の部分拡大構成図である。
 【図4】そのカラー複写機の要部拡大構成図である。
 【図5】そのカラー複写機で用いるトナーリサイクル装置の分解斜視図である。
 【図6】そのトナーリサイクル装置の現像装置側の縦断斜視図である。
 【図7】単色画像形成装置の要部構成図である。
 【図8】別の単色画像形成装置の要部構成図である。
 【図9】この発明で用いる現像装置のイラスト図である。
 【図10】（トナー帯電量）／（トナー粒径）の分布曲線図である。
 【図11】その分布曲線の半値幅と地汚れとの関係図である。
 【図12】中間転写体の硬度と像担持体への食い込み量との関係図である。
 【図13】別の例の中間転写体クリーニング装置まわりの拡大構成図である。

【図14】その中間転写体へのトナー付着状態を示す部分拡大図である。
 【図15】その中間転写体への別のトナー付着状態を示す部分拡大図である。
 【図16】その中間転写体上に形成したトナー頭像パターンの硬度を測定する光学検知手段の構成説明図である。
 【図17】画像パターンによる後出力電圧を示す図である。
 【図18】トナー付着力低減装置の層厚の変化を示す図である。

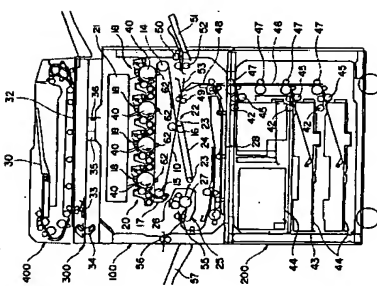
10 【図18】 トナー付着力低減装置の層厚の変化を示す図である。

【図19】 中間転写体の等価回路図である。

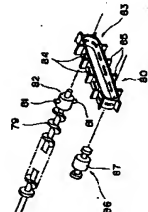
【符号の説明】

- 10 中間転写体
- 12 弾性層
- 13 コート層
- 17 中間転写体クリーニング装置
- 18 単色作像手段
- 20 タンデム作像装置
- 22 2次転写装置
- 40 像担持体
- 61 現像装置
- 63 像担持体クリーニング装置
- 80 トナーリサイクル装置
- 92 ファーブラス
- 93 クリーニングプレート
- 96 粒子結着体
- 97 転子
- 98 トナー付着力低減層
- 99 トナー
- 100 複写機本体（画像形成装置本体）
- 110 発光素子
- 111 受光素子

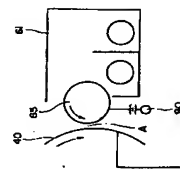
【図1】



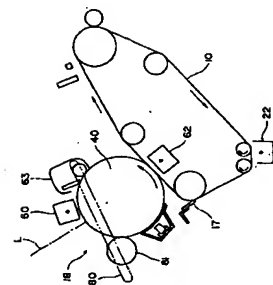
【図5】



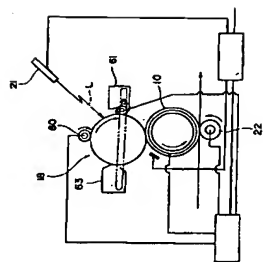
【図9】



【図7】

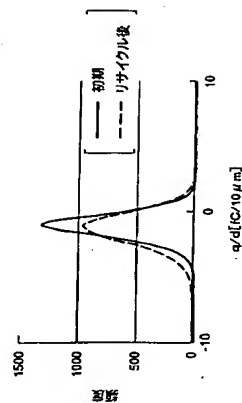


【図8】

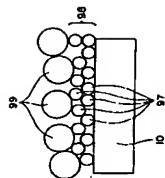


【図10】

初期とリサイクル後の比較
 q/d 分布

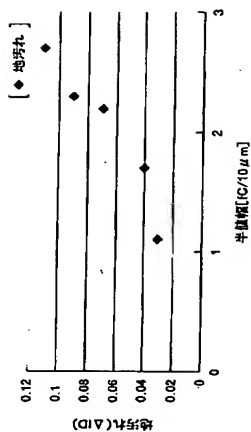


【図15】

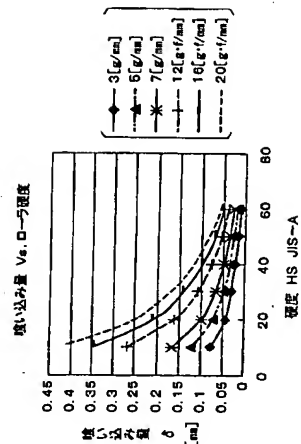


【図11】

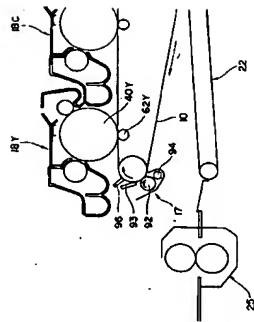
地汚れと半値幅の関係



【図12】



【図13】



【図19】

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GA34 GA45 GA47 GA49 GA57

GB12 GB13 GB22 GB25 GB50

HA02 HA12 HA28 HB03 HB12

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JC16 JC17 LA18 LA19 LB02

LB08 LB09 LB12 LB13 LB35

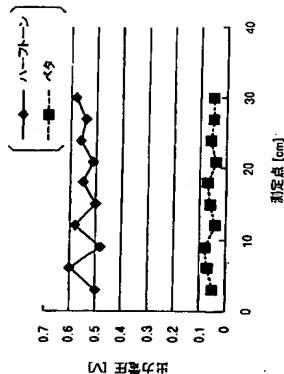
LB37 MA01 MA04 MA20 MB04

MB05 MB10 MC08 MC10 MC14

MC15

【図17】

図像パターンによる検出力



【図18】

粒子層厚の変化

